US Army Corps
of Engineers
Waterways Experiment
Station

Miscellaneous Paper GL-96-24
August 1996

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Final report

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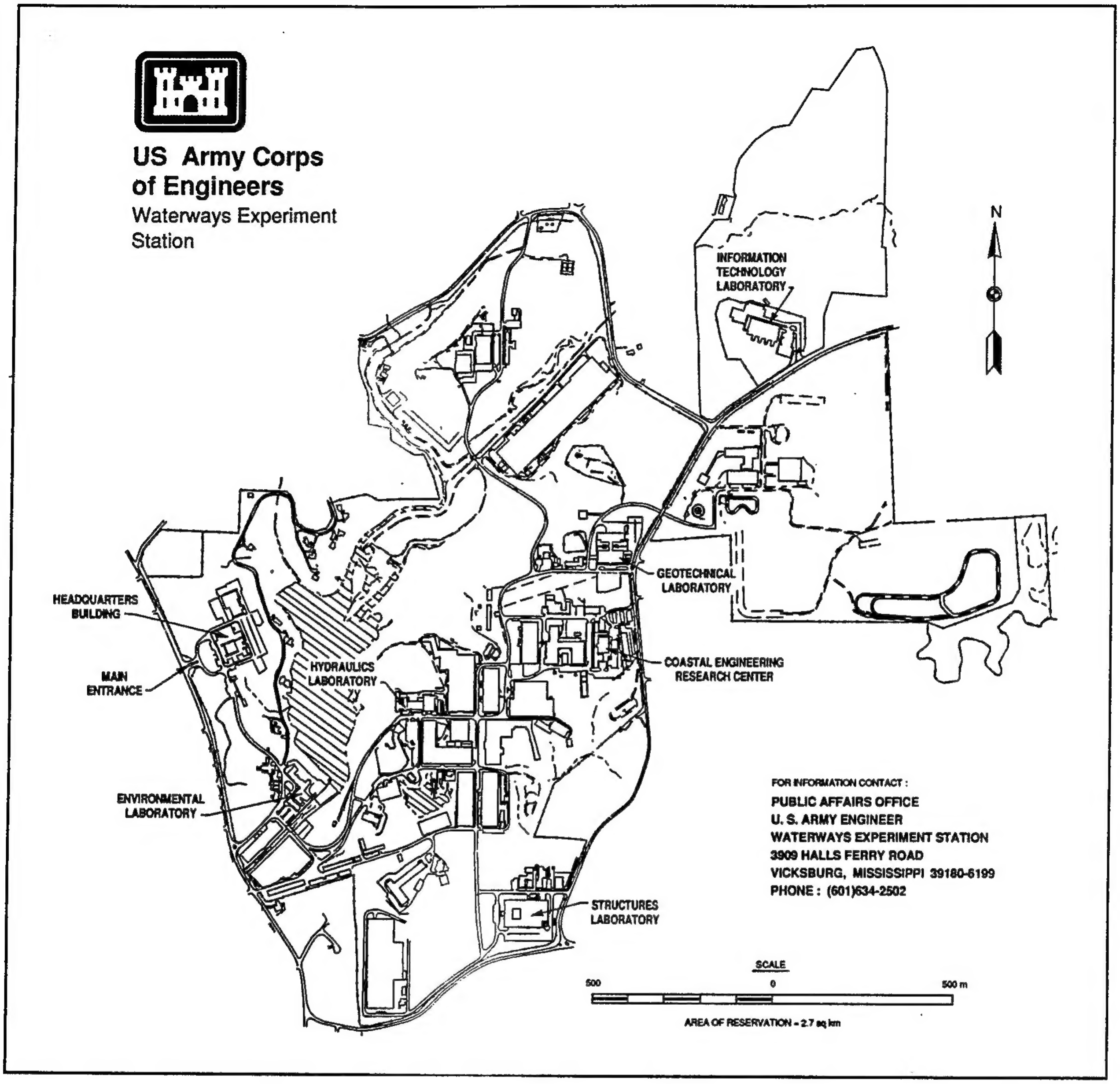
Prepared for Defense National Stockpile Center
Fort Belvoir, VA 22060



Waterways Experiment Station Cataloging-in-Publication Data

Sjostrom, Keith J.
Noninvasive weight determination of stockpiled ore through microgravity measurements / by Keith J. Sjostrom, Dwain K. Butler ; prepared for Defense National Stockpile Center.
162 p. : ill. ; 28 cm. -- (Miscellaneous paper ; GL-96-24)
Includes bibliographic references.
1. Gravity -- Measurement. 2. Ores -- Density -- Measurement. 3. Ores -- United States -- Inventory. 4. Reduced gravity environments -- Measurement. I. Butler, Dwain K. II. United States. Army. Corps of Engineers. III. U.S. Army Engineer Waterways Experiment Station. IV. Geotechnical Laboratory (U.S. Army Engineer Waterways Experiment Station) V. Defense National Stockpile Center (U.S.) VI. United States. Defense Logistics Agency. VII. Title. VIII. Series: Miscellaneous paper (U.S. Army Engineer Waterways Experiment Station) ; GL-96-24.
TA7 W34m no.GL-96-24

Contents

List of Figures

Preface

A geophysical research program to determine the material density and overall weight of selected stockpiles of high-grade ores has been conducted by personnel of the Engineering Geophysics Branch, Geotechnical Laboratory (GL), U.S. Army Engineer Waterways Experiment Station (WES). Analysis of microgravity measurements provide representative bulk density values of the high-grade ore, and the weight of each ore pile is determined by multiplying the computed bulk density value and measured ore pile volume. Microgravity measurements were collected at the Sierra Army Depot, California, during the period 6-14 November 1995 and at the National Refractory and Minerals Corporation, California, Hammond Depot, Indiana, Ravenna Army Ammunition Plant, Ohio, and Somerville Depot, New Jersey, during the period 27 November - 5 December 1995. The research was performed under sponsorship of the Defense National Stockpile Center (DNSC) of the Defense Logistics Agency. The DNSC Project Coordinator was Mr. G. A. Vanegas.

The overall test program was conducted under the general supervision of Dr. W. F. Marcuson III, Director, GL, and A. G. Franklin, Chief, Earthquake Engineering and Geosciences Division (EEGD). Dr. Dwain K. Butler and Mr. Keith J. Sjostrom were the principal investigators. This report was prepared by Mr. Sjostrom under the supervision of Mr. J. R. Curro, Jr., Chief, Engineering Geophysics Branch, and Dr. Butler under the supervision of Dr. Franklin, Chief, EEGD, GL. Data acquisition and analysis support was provided by Dr. Janet E. Simms and Mr. Rodney L. Leist, EEGD, GL. Assistance in report preparation was provided by Ms. Lori M. Davis, EEGD, GL. Graphical presentation of the ore piles was provided Mr. Grady A. Holley, Applied Research Associates, Vicksburg, MS.

Acknowledgement is made to Messrs. Mark Mattox, Willie J. Brown, Albert Ventura, Jr., and Michael Steinkuehler, and other employees of EMC, Inc. of Greenwood, MS, for surveying and determining the volume of each ore pile, providing the elevations of each gravity station, and assisting in the layout of the geophysical survey lines. The topographic surveys were performed during the periods 5-17 November and 26 November - 5 December 1995.

At the time of publication of this report, Director of WES was Dr. Robert W. Whalin. Commander was COL Bruce K. Howard, EN.

Conversion Factors, Non-SI to SI Units of Measurement

Non-SI units of measurement used in this report can be converted to SI units as follows:

Multiply	By	To Obtain
feet	0.3048	meters
tons	2000.0	pounds
pounds	0.45359	kilograms
tons	907.1847	kilograms
cubic yards	0.7646	cubic meters
pounds per cubic foot	0.01602	grams per cubic centimeter
pounds per cubic foot	16.0184	kilograms per cubic meter
miles (U.S. statute)	1.6093	kilometers
Gal (measure of gravity)	1.0	centimeter per second squared
Gal (measure of gravity)	0.01	meter per second squared
microGal	1.0×10^{-8}	meter per second squared

1 Introduction

Background

The Defense National Stockpile Center (DNSC) of the Defense Logistics Agency (DLA) maintains stockpiles of high-grade ores at various defense depots throughout the country. While the initial or as-delivered weights of many of the piles of materials are known or have been estimated in previous years, the measures or estimates, many of which are 30 to 40 years old, may not be reliable. DNSC has a requirement from the Inspector General's Office, DLA, to produce current weight estimates for statistically selected piles as part of an Audit of National Defense Stockpile Transaction Fund for the Fiscal Year 1995 Financial Statements. The reliability of the weight estimates are important for assessing the current ore inventory within the federal government and for setting fair market values of the material when the ore stockpiles are sold to industry.

DNSC requested assistance from the U.S. Army Engineer Waterways Experiment Station (WES) in determining densities for 14 piles of heavy metal ores in the Defense National Stockpile at five locations: Sierra Army Depot and National Refractory and Mineral Corporation, California; Hammond Depot, Indiana; Ravenna Army Ammunition Plant, Ohio; and Somerville Depot, New Jersey (see Figure 1). The pile materials are all heavy metal ores consisting of either chromite, manganese, tungsten, ferrochrome, or ferromanganese. The ore pile materials range in size from fine grained particles to boulders.

Standard geotechnical methods for bulk density determination are not readily applied to the in-place pile materials because of high ore density values and large range in size of the ore material. Measuring the near-surface density of the pile materials by a technique such as the ring density test will not likely give density values representative of the material near the bottoms of the piles. Any density determination method which requires displacing materials, which are placed in known volume containers and weighed, are not reliable or representative of the in-place materials.

A method for computing the weight of the in-place ore stockpiles and determining a truly representative bulk density for each pile is to measure the

gravitational attraction of the piles. The gravitational attraction of the piles is the result of the integrated effect of the in-place bulk material density distributed over the volume of the pile. Analysis of the gravitational anomaly recorded over piles of ore results in estimates of the representative bulk density of the ore material. By combining the density values with the surveyed pile volume determinations, pile mass and weight can be computed for each pile. Gravitational determination of near-surface densities for use in gravity survey data reductions are done routinely in geophysics. However, determination of densities by gravity surveys is a non-standard technique for the present application and cannot promise the same level of accuracy as laboratory density determination or a precisely controlled geotechnical field density determination.

Purpose and Scope

The objectives of this research program are to determine the material density and weight of 14 ore piles representative of the ore stockpiled under DNSC jurisdiction. The results will be used to check the current ore inventory as part of an audit of the National Defense Stockpile Transaction Fund, Fiscal Year 1995 Financial Statements. Pile volumes are determined using standard topographic surveying procedures. Material density values are derived through analysis of microgravity measurements performed over each ore pile. Pile weight is the product of the pile volume and material density.

Location of Test Sites

Fourteen ore piles were statistically chosen by the Inspector General's Office to be audited. These piles represent a cross-section of the entire ore inventory under the jurisdiction of the DNSC. The selected ore stockpiles are located as follows. Eight ore piles are located at the Sierra Army Depot in Herlong, CA; located approximately 60 miles north-northwest of Reno, NV. The pile designations, material types, dimensions, and originally reported gross weights, as provided by DNSC, are listed in Table 1. The material breakdown by pile is as follows: one pile of tungsten ore (Pile No. 15), two piles of manganese ore (Piles No. 10 and No. 14), and five piles of chromite ore (Piles No. 1, 3, 5, 6 and 18A). The ninth pile of the project is located at the National Refractory and Minerals Corporation in Moss Landing, CA; north of Monterey, CA. This pile, Pile No. 1, is composed of Type B chromite ore as listed in Table 1.

Located at the Hammond Depot in Hammond, IN, the tenth ore pile of the survey, labelled as Pile No. 12 in Table 1, is composed of high-carbon ferromanganese. Three of the fourteen piles selected for this study are located at the Ravenna Army Ammunition Plant west of Warren, OH. The piles, as

listed in Table 1, are composed of metallurgical grade manganese (Pile No. 20), metallurgical grade chromite (Pile No. 8), and low-carbon ferrochrome (Pile No. 22). The final pile of the study is located at the Somerville Depot south of Somerville, NJ. The ore pile is denoted as Pile No. 1 and material classified as chemical grade chromite ore (see Table 1).

2 Principles of Microgravity Surveying

The Microgravity Method

Gravimetry comes closest of any geophysical method to allowing a positive statement regarding the nature (positive or negative) and magnitude of subsurface density anomalies. Near-surface density anomalies produce localized variations in the gravitational force field on the surface of the earth. Systematic measurements of the gravitational field with a gravimeter allows the field to be mapped on the surface of the earth. The gravity anomaly field is determined relative to the survey area of interest by correcting the measured gravity field for the normal gravitation field of the earth and any large scale gravity effects. Analysis of the gravity anomaly field results in estimates of the density contrast between the densities of the anomalous feature and surrounding material and the depth and geometry of the localized feature.

In many cases, analysis of the surface gravity anomaly allows the mass excess or deficiency associated with the density contrast to be determined (Butler 1980; Telford et al. 1990). When the two density values associated with the density contrast and the volume of the feature are known or can be measured, then the actual mass associated with the localized feature can be determined. For cases where a profile of gravity measurements crosses a topographic surface feature such as a hill, ridge, or pile and the surface feature is entirely above some reference datum, it is possible to determine the actual bulk density of the material comprising the structure directly from the gravity measurements (Nettleton 1940; Parasnis 1979; Telford et al. 1990). It is this last capability that is used in the ore pile investigations.

Microgravimetry refers to high-resolution, high-accuracy surveys of the gravitational field (acceleration) with gravimeters that have measurement sensitivity and accuracy of approximately 1 microgal (1 μGal), where 1 μGal = 10^{-6} Gal = 10^{-6} cm/s^2. Since the normal earth's gravitational field on the surface is approximately 1,000 Gal, microgravimetry involves measurements of gravity with precision and accuracy 10^{-9} times that of the normal earth's gravitational field. The measurement characteristics of gravimeters used for

microgravity surveys are discussed in detail in Butler (1980) and Torge (1989). The microgravity measurements recorded for this study were completed using a LaCoste and Romberg Model D Gravimeter. A photograph of the instrument is presented in Figure 2. The design of the meter allows it to be very sensitive to small changes in gravity. As a simplified description, the inner workings of the meter consist of a small, calibrated mass connected to one end of a horizontal beam. At the other end of the beam, a pair of fine wires and springs are positioned so as to act as a frictionless hinge. The beam is also supported just behind the mass by an adjustable, calibrated spring. Once the gravity meter is leveled at a measurement station, the meter is read by nulling the mass, i.e. adding or subtracting a small amount of force via the calibrated spring to the mass to restore it to the same 'reading' position as at the previous station. This process is done using a lever system and dial calibrated over a 200 milligal range. A conversion table unique to each gravity meter translates the dial readings into gravity values.

Microgravimetric surveys are of two types: (a) profile surveys, where gravity measurements are made along a profile line that is generally perpendicular to the presumed strike of a linear-type structure, such as a fault, anticline/syncline, buried river channel, or in the case of the present investigation an elongated pile of material on the surface; and (b) areal surveys, where gravity measurements are made at stations on a grid over an area. Microgravity surveys are often conducted with measurement points separated by 5 to 30 ft to enhance the detectability and resolution of small and closely spaced subsurface features. Station locations and relative elevations must be accurately determined by a site leveling survey in which the station locations and elevations are measured to the nearest 0.1 and 0.01 ft, respectively. The field procedures used for the surveys are dictated by considerations of survey objectives and subsequent corrections which must be made to the measured data. The measurements in a microgravity survey are normally made relative to a local reference station, and there is usually no attempt to tie the values to an absolute gravity determination.

Gravity Data Corrections

Corrections to gravity survey data are required in order to compensate for normal gravity variations over the survey area and over the time span required for the survey. Measured values are reduced in such a manner as to imply that all the gravity data were collected along the same reference datum by implementing gravity corrections for the effects due to latitude, elevation, topography, earth tides, and instrument drift. In this manner, variations in the corrected gravity values are then assumed to be due solely to the geologic structures of interest. The normal gravity variations and compensating corrections applied to microgravity data are discussed below:

Corrections for time variations (drift). Gravity values over the survey area change with time because of earth tides and instrument drift. Earth tides, like ocean tides, are caused by the orientation of the sun and moon and are of sufficient amplitude to be detected by sensitive gravity meters. Instrument drift is caused by creep of the metal components in the meter (springs, rods, etc.) due to thermal expansion or excessive movement. Over short time periods (less than 60 min), drift due to tidal and instrument fluctuation can be assumed to be linear over time. The usual procedure for correcting for drift is, therefore, to reoccupy a base station frequently and assume that the gravity values at all stations in the survey area vary in the same manner between readings at the base station. Differences in readings at the base station are plotted with respect to time to produce a drift curve. The drift correction, denoted as Δg_{zD}, for each station is determined directly from the graph. Positive drift requires a negative correction and vice-versa.

Latitude correction. Both the rotation of the earth and its non-spherical shape produce an increase in gravity values with latitude. For microgravity surveys, it is usually sufficient to assign a reference latitude to the base station and use the following equation to compute latitude corrections, denoted as Δg_{zL}, for all other stations:

$$\Delta g_{zL} = \pm \left(0.2471 * \sin(2\phi) \frac{\mu Gal}{ft} \right) * \Delta s \qquad (1)$$

where Δs is the north-south distance (in feet) between the measurement and base station and ϕ is the reference latitude of the base station. The correction term is added to the measured gravity value if the station is positioned south of the base station and subtracted if located north of the base station.

Free air correction. The free air correction, denoted as Δg_{zFA}, compensates for the fact that the gravitational attraction varies because of changing distance from the center of the earth. The normal free air vertical gravity gradient (0.09404 mGal/ft) is essentially constant and can be used for all stations in a microgravity survey. Since the results of a microgravity survey are entirely relative, any reference elevation (the elevation of the base station, the geoid, or mean sea level) can be used and only station elevations relative to this reference elevation are needed. The free air correction formula is

$$\Delta g_{zFA} = \pm\ 94.041 \frac{\mu Gal}{ft} * \Delta h \qquad (2)$$

where Δh is the difference in elevation (in feet) between the measurement station and reference elevation. The correction is added to the measured gravity value if the station is higher in elevation than the reference elevation, and vice versa.

Bouguer correction. The Bouguer correction compensates for the fact that gravity values in a survey area are affected by differing masses of material beneath the stations due solely to elevation variations. For the Bouguer correction, a reference elevation is chosen (preferably the same as used for the free air correction), and the material between the ground surface at each station and the reference elevation is approximated by an infinite horizontal slab with density equal to that of the material beneath the station. The correction, denoted as Δg_{zB}, is calculated using the Bouguer slab formula:

$$\Delta g_{zB} = \pm \left(12.774 * \rho \frac{\mu Gal}{ft} \right) * \Delta h \tag{3}$$

where ρ is the material density of the slab (in g/cm^3) and Δh is the elevation difference (in feet) between the measurement station and reference elevation. The quantity Δg_{zB} is subtracted from the measured gravity if the station is above the reference elevation, and vice versa. The appropriate density for the Bouguer correction in a microgravity survey can frequently be determined by direct density measurement or by procedures discussed in the next chapter under 'Determination of Material Density'.

Other data corrections and data analysis procedures, such as terrain corrections and regional-residual separation normally required for microgravity surveys, are not required for the ore pile microgravity study. Gravity values, corrected only for time and latitude variations, recorded over a topographic feature, such as an ore pile, are observed to be inversely correlated to the topography of the feature being surveyed. If the gravity profile data are also free air corrected, the free air anomaly profile is observed to be directly correlated with topography. Provided the correct density for the material comprising the topographic feature is subsequently used in the Bouguer correction, the correlation between the gravity anomaly and topographic profile is essentially eliminated or minimized. It is this observation that is used in the next section to determine the bulk density of the ore piles.

When all of the preceeding corrections have been applied to the observed gravity data, the result is the Bouguer gravity value, denoted as g_B. The Bouguer gravity value at a measurement station is given by

$$g_B = g_{obs} \pm \Delta g_{zL} \pm \Delta g_{zFA} \pm \Delta g_{zB} \pm \Delta g_{zD} \tag{4}$$

where g_{obs} is the observed gravity reading and the remaining terms are the gravity corrections discussed above. Subtracting the gravity readings recorded at the base station, denoted as g_{base}, from the Bouguer gravity values at each station using the equation

$$\Delta g_B = g_B - g_{base} \tag{5}$$

results in the Bouguer gravity anomaly. The Bouguer gravity anomaly is used in determining the density of the ore pile material whether through direct calculation or gravity modeling algorithms.

Field Procedures

Gravity measurements are collected along traverses established across the base, side slopes, and tops of each ore pile. The gravity survey lines must be established and measured using microgravimetric procedures such as those outlined in Butler (1980). For piles that are elongated in one direction, the profile lines are oriented approximately perpendicular to the elongation direction. Each survey line consists of approximately 17 to 21 measurement stations much like the one shown in Figure 3. The measurement stations are located so that at least four stations are positioned on either side of and off the pile on non-ore, natural earth material (see Figure 4) to provide background gravity readings necessary for analysis of the data. The remaining 9 to 11 stations are located on the side slopes and tops of the ore piles as shown in Figure 5. These are the measurement stations from which the gravity anomaly is determined and material densities derived. Horizontal spacing between stations varies according to the number of gravity stations and overall dimensions of the piles, typically varying from 5 to 20 ft (1.5 to 6 m). Horizontal locations (x,y coordinates) and elevations (z coordinate) are established by electronic surveying instruments using standard topographic surveying procedures. Horizontal positions are measured to an accuracy of 0.1 ft and elevations are determined to an accuracy of 0.01 ft using, at most locations, a reference elevation of 100 ft. In addition to the position surveying performed for establishing the gravity survey lines, position measurements are also acquired for use in determining pile volumes. Further details regarding the position surveying procedures are presented in the next Chapter.

For the gravity measurements and data corrections, each gravity profile line has a base station located off the pile at the "start" of the survey line (see Figure 6). All elevations and gravity measurements along the line are referenced to the base station elevation and base station gravity measurement. The gravity measurements along each profile line are determined in two measurement programs. Following the initial gravity readings at the base station, the first measurement program consists of approximately 10 measurements as the survey proceeds towards (see Figure 7) and up the slope (see Figure 8) of the ore pile, stopping at a measurement station that is located approximately

halfway along the profile line and often at the highest elevation of the line. Once the reading at the top of the pile is collected, the gravity survey loops back to the base station for additional readings to conclude the first program. The second measurement program for the profile line starts at the opposite end of the line from the base station and proceeds up the 'back' side of the ore pile. Gravity readings are collected until the midway point along the survey line, located on top of the pile, is reached. This station is the same stopping point as used for the first program. After recording the gravity meter reading, the survey again loops back to the base station for the third and final set of readings. This two program procedure results in three measurements at the base station and two readings at the central measurement point of the line. The multiple base stations measurements are used for earth tide and instrument drift corrections and data quality control. Since measurements at the base station are used for reference and for correcting all other measurements on the line, special care is exercised in acquiring base station measurements (Butler 1980). The two measurements at the central measurement point are also used for survey quality control. A time and equipment performance constraint is applied to each survey line. If any type of equipment problem occurs during a program, the entire program is repeated. If the total time required to survey a profile line exceeds 60 minutes, the survey line is subdivided into three programs. However, survey lines are typically completed in less than 60 minutes. Also, if the data quality and multiple readings are not within set limits, the survey program may have to be rerun.

Two procedures can be used to determine a representative in-place bulk density from microgravity surveys for a given pile:

a. Model the geometry of the pile and compute the gravitational attraction and compare to the measured profile; then vary the density systematically until the calculated profile matches the measured profile; the density which yields the best match is the proper representative in-place density;

b. Correct the measured gravity data for instrument drift, latitude corrections, and elevation variations relative to the base elevation at the beginning of the survey line; then systematically vary the density used in a Bouguer elevation correction to the data; finally, compare the shape of the resulting gravity profile to the elevation profile and the density value for which the gravity profile shows the least correlation to elevation is the proper in-place density.

Both of the above procedures are well established and recognized geophysical methods (Telford et al. 1990; Dobrin, 1976; Parasnis, 1979; Butler, 1980; Butler et al. 1982). While the density values from the two procedures should agree within their respective measurement and numerical accuracies, there may be significant differences in their ease and efficiency of application; dependent primarily on individual pile geometry. Where possible, both procedures are used for the density determinations.

Depending on the pile geometry, two to five profiles are established crossing each pile which results in the determination of two to five spatially distributed, volume-averaged bulk density values for each pile. The density values are averaged, thereby resulting in a single in-place density value for the ore pile material with computed standard deviations to reflect the confidence interval of the result.

3 Data Analysis and Results

Determination of Ore Pile Volume

Topographic surveys to compute the volumes of the ore stockpiles were completed using standard land surveying methods. Topographic field data were collected using a Topcon GTS-3C Total Station with a Hewlett Packard 200 LX Data Collector. Horizontal data were referenced to an arbitrary coordinate system using the point 100,000 North/100,000 East (in U.S. survey feet) as the origin and a reference elevation of 100 ft. Azimuthal orientation is zero degrees North. The limits of the topographic survey program were from toe to toe of each ore stockpile while taking into account all ridges, depressions, and other significant characteristics in the surfaces of the stockpiles. The base of each stockpile is determined by a planar surface passing through the elevation points along the toe of the pile. *It should be noted that any ore material below the planar surface, caused by pile settlement or an irregular, original placement surface, is not included in the pile volume determination and, hence, the ore stockpile weight.*

Contour mapping of the relative elevation data were done for each pile using a one foot contour interval. Volumes were computed, using Intergraph InRoads software, from the three-dimensional pile representations incorporating the triangle, grid, and end-area methods. The grid method is based on a mesh of 0.5 ft and the end-area method is based on cross-sections spaced five feet apart. The computed volumes for each pile using each method are reported in units of cubic yards (yd^3) and can be found in Appendix A. The average volume of each pile is noted on the contour plots, listed in Table 2, and used in the weight calculation of ore material.

Determination of Material Density

In standard gravity surveying to determine geologic structure, the Bouguer corrections in the reduction of gravity data require a knowledge of the average densities of the near-surface rock and sediments. In the application of gravity measurements to estimate the surface and subsurface densities of earth materials, such as in this project, three methods were used to estimate the density

of the ore pile materials. The first method, developed by Nettleton (1940), is an indirect, graphical technique to determine density. Plotting gravity data that are collected over an ore pile and have undergone the drift, latitude, and free air corrections, the gravity curve at this point is strongly correlated to the shape of the measured topography curve over the pile. Applying the Bouguer correction numerous times over a range of material density values, the resultant gravity anomaly curve that has the least correlation, ideally a correlation factor of zero, is considered to be the most nearly correct bulk density value for the ore pile material. This method has the advantage of averaging the effect of density variations more accurately than can be done from surface or core samples (Dobrin, 1976). This method works best when the near-surface material is relatively homogeneous in nature.

The second method is an analytical approach developed by Parasnis (1979) and similar to Nettleton's graphical method. Parasnis assumes that if the correct material density is used for the Bouguer correction, then the Bouguer gravity anomaly defined in Equation 5 will be a random error with a mean value equal to zero (Telford et al, 1990) as shown below:

$$0 = \Delta g_B = g_B - g_{base} \tag{6}$$

Expanding the above equation to include the observed gravity readings and all of the gravity correction terms, we obtain the equation

$$0 = g_{obs} - g_{base} + \left[\pm g_{zD} \pm g_{zL} \pm g_{zFA}\right] \pm g_{zB} \tag{7}$$

Further expansion of the Bouguer correction term, Δg_{zB}, in Equation 7 and subsequent algebra solving for the material density parameter ρ, we get

$$\rho = \frac{g_{obs} - g_{base} + \left(\pm \Delta g_{zD} \pm \Delta g_{zL} \pm \Delta g_{zFA}\right)}{12.774 * \Delta h} \tag{8}$$

where ρ is defined in terms of g/cm^3. Plotting the terms in the numerator versus the terms in the denominator, the best fit straight line through the data points is the bulk density of the ore pile material.

Depending on the dimensions of each ore pile, two to five gravity surveys are performed to determine the average bulk density of the ore material. During the analysis portion of this study, Nettleton's and Parasnis' method were used to compute the density value over an individual survey line. Each method provided the same result as expected. The two to five survey lines conducted over an ore pile results in the determination of the same number of spatially distributed, volume-averaged bulk density values for each pile. The bulk density values are averaged to determine a single in-place density value for the ore pile material. Standard deviation values were also computed to reflect the confidence interval of the result.

The third method used to assist in the determination of the bulk density of an ore pile is a two-and-a-half dimensional gravity modeling routine developed by Cady (1980). The computer algorithm uses as input the Bouguer gravity anomaly values calculated using Equation 5 for data collected perpendicular to the strike of a two dimensional (2-D) feature of finite length. An ore pile is an excellent example of such a feature. The topographic survey data along the gravity survey line are used to construct a detailed 2-D cross-section of the ore pile. Theoretical gravity values are calculated by inputting various estimates of the material density into the gravity modeling algorithm. The best density estimate is that value which provides the lowest least squares error between the observed and calculated gravity data. This method is much more cumbersome and time consuming than the first two methods, however, the advantage of this method is that it allows investigation of possible settlement of the ore pile material. This program was used primarily at the Sierra Army Depot where settlement of the ore piles was a concern.

Calculation of Ore Pile Weight

Following the determination of the representative material density from the microgravimetric measurements, the total weight of the ore pile material is calculated by incorporating the volume estimates of each respective ore pile. The gravimetrically derived weight of the above-ground ore pile material is computed using the equation

$$Weight = (\rho) * \left(62.428\ \frac{lb}{ft^3}\right) * \left(27\ \frac{ft^3}{yd^3}\right) * (V) \tag{9}$$

where ρ is the computed density of the ore pile material (in g/cm^3) and V is the volume of the ore pile (in yd^3) above the ground surface. The total weight is given in units of pounds (lbs).

Accuracy and Percent Difference

Based on experience and published examples (Parasnis, 1979; Telford et al. 1990), the pile density determination accuracy is estimated to be approximately $\pm$ 0.2 g/cm^3 (12.5 lb/ft^3). For example, if the bulk inplace density determination is estimated to be 2.5 g/cm^3, this accuracy estimate translates to approximately $\pm$ 8 percent of the true value. For more dense ore pile material, the computed densities become more accurate.

Discussions with the registered land surveyor leading the ore pile volume determination portion of this effort established a volume determination accuracy of $\pm$ 5 percent. The volume accuracy clearly depends on the following factors: (1) number of data points used to characterize the pile, (2) definition

of irregularities in the ore pile geometry, and (3) accurate determination of the base and outside edge of the pile. It also should be remembered that any portion of the ore material below grade (i.e. below the surrounding ground surface level) caused by material settlement or an irregular placement surface cannot be accounted for in the land survey volume determination.

Based on the above considerations for ore material density estimation and pile volume determination, the computation of the weight of the ore pile should be accurate to within ± 10 to 14 percent depending on the actual density of the ore pile material. Outside factors such as settlement of the ore material, irregular pile geometries, and poor gravity data quality will increase the error range.

The difference between the original reported ore pile weight value when the material was placed at a site and the calculated weight is given in terms of percent using the equation

$$Difference = \left(\frac{|\,Reported - Calculated\,|}{Reported} \right) * 100\% \tag{10}$$

where "Reported" and "Calculated" are the respective pile weights in units of pounds (lbs). In the discussion of the results, negative percent differences represent calculated pile masses that are less than the reported gross weights. Comparing the calculated results to the reported gross weights, it was found that for every pile of material, except one, the computed weight was smaller than the reported weight. This, however, seems reasonable since there has been considerable scatter of material over time, the ground beneath some of the piles may have settled since placement, and some unaccounted for material may have been removed or consolidated with other piles. Also, there is no way to account for the weight of any ore material which is below the ground surface or the horizontal plane determined by the survey crew representing the base of the pile.

Results

The computed density values of the stockpiled ore for each pile at the five sites is multiplied with the respective ore pile volume to determine the total weight of ore material. The computed results for each pile are listed in Table 2 and the differences between the computed weight and originally reported ore pile weights are presented in Table 3. Negative percent differences indicate that the computed ore pile weight values are less than those values reported by DNSC.

Sierra Army Depot, California

Eight piles of stockpiled ore were surveyed at the Sierra Army Depot. The pile descriptions, dimensions, and reported weights as provided by the DNSC are listed in Table 1. The results following the gravity surveys for each pile, listed in numerical order, are described below.

Pile No. 1: Chromite Ore. Pile No. 1 at the Sierra Army Depot consists of 11,797,640 lbs of domestic, metallurgical chromite as documented by DNSC. Three gravity survey lines were performed over the pile as indicated in the elevation contour plot of the ore pile in Figure 9. Each survey line had 10 gravity stations located on the ore material. Computed densities derived using the gravity data analysis procedures and algorithms range from 1.99 to 2.12 g/cm^3. The average material density is 2.063 g/cm^3 with a standard deviation of $\pm$0.054 g/cm^3. The average volume of the ore pile material is estimated at 2015.9 yd^3. Using the computed averages for the material density and pile volume (see Table 2), the estimated total weight of Pile No. 1 is approximately 7,009,893.2 lbs. The difference between this computed weight in relation to the weight on record (see Table 3) is approximately -40.5 percent. Incorporating the standard deviation of the computed material density, the estimated weight range for Pile No. 1 is $\pm$183,487.3 lbs.

Within a few weeks after the gravity measurements were collected over Pile No. 1, the ore material was removed from Sierra Army Depot. The material was weighed as it left the base and the cumulative weight was approximately 9,000,000 lbs, or approximately 2,800,000 lbs less than the reported gross weight. The difference between this measured value and the weight calculated from the gravity measurements is -22.1 percent. The pile was also found to have settled 1 to 2 ft near the center of the pile; thus, the material below the surveyed planar base of the pile was not included in the calculated weight.

Pile No. 3: Chromite Ore. Pile No. 3, surrounded on three sides by wooden barricade, is described as domestic, metallurgical chromite ore having a reported weight of 34,529,495 lbs (see Table 1). An elevation contour plot of the ore pile is illustrated in Figure 10. Three gravity surveys were performed over the pile (see Figure 10) with nine of the nineteen gravity stations comprising each survey line positioned on the ore material. Computed densities range from 2.33 to 2.44 g/cm^3 with an average value of 2.393 g/cm^3. Incorporating a measured volume of 7,215.7 yd^3, the estimated weight of Pile No. 3 is 29,104,782.2 lbs as indicated in Table 2. The standard deviation of the computed material density values is $\pm$0.046 g/cm^3 which reflects an error bound on the weight estimate of $\pm$559,473.5 lbs. The computed weight of the chromite ore varies from the reported gross weight by -15.7 percent.

In January 1996, this pile of ore was also being removed from the Sierra Army Depot. At the time this report was written, the measured weight of Pile No. 3 had not yet been determined.

Pile No. 5: Chromite Ore. Pile No. 5 is an irregular shaped pile of metallurgical grade chromite ore. The ore is comprised mostly of cobble to boulder size material as shown in Figure 11. An elevation contour map of the ore pile is presented in Figure 12. Pile No. 5 has an estimated volume of 5,353.6 yd^3. Four gravity surveys were performed over the width of the pile (see Figure 12) with 9 to 10 gravity stations positioned on the ore material. Analysis of the corrected gravity data yielded material density values varying from 2.31 to 2.52 g/cm^3. The average gravimetrically derived density of the chromite ore is 2.425 g/cm^3 with a standard deviation of ± 0.084 g/cm^3. Substituting the appropriate values into Equation 9, the estimated weight of Pile No. 5 is 21,882,697.1 lbs with a possible deviation of $\pm 757{,}998.6$ lbs. The reported gross weight as provided by DNSC is 31,022,600 lbs and is approximately 29.4 percent greater than the average calculated weight determined from the gravity data.

Pile No. 6: Chromite Ore. Pile No. 6, as shown in Figure 13, is comprised of chromite ore and has a reported gross weight of 54,917,860 lbs as indicated in Table 1. Prior to the gravity or topographic surveys, Pile No. 6 was shown on a map as a separate pile of ore adjacent to another pile, Pile No. 18, of chromite material. However, upon arrival at the site, the two piles had been pushed together and there was no clear boundary between the two piles. By approximating the boundary location, a contour plot of the measured elevations is shown in Figure 14 and the estimated volume of Pile No. 6 is 13,181.9 yd^3. Three gravity survey lines were performed over the pile (see Figure 14) with 10 to 12 stations situated on the ore material depending on the width of the pile. The gravity data were analyzed yielding computed material density values ranging from 2.35 to 2.58 g/cm^3. The average computed density of the chromite ore is 2.503 g/cm^3 with a standard deviation of ± 0.108 g/cm^3. Calculation of an average weight for the ore material yields a value of 55,613,733.1 lbs which is approximately 1.2 percent greater than the reported gross weight (see Table 3).

Pile No. 10: Manganese Ore. Pile No. 10 is a small pile of manganese ore (see Figure 15) having a reported gross weight of 1,846,185 lbs as listed in Table 1. An elevation contour plot of the pile is illustrated in Figure 16 and, as shown in the figure, the maximum elevations of the pile are much less than the reported height of 10 ft. The computed volume of the ore material is 450.5 yd^3. Two gravity survey lines traversed the ore pile with 9 of the 17 measurement stations positioned on the ore material as shown in Figure 16. Analysis of the corrected gravity values provided density estimates of the manganese ore ranging from 1.91 to 2.10 g/cm^3. The average material density is 2.005 g/cm^3 and has a standard deviation of ± 0.095 g/cm^3. The average calculated weight of the ore is 1,522,482.7 lbs (see Table 2). Comparing the computed weight to the reported weight provided by DNSC, a difference of -17.5 percent exists as shown in Table 3.

Pile No. 14: Manganese Ore. Pile No. 14 is an elongated pile of manganese ore with a reported gross weight of 34,869,960 lbs. The width of the

pile along most of its length is approximately 50 ft except at the southern end of the pile. The contour plot illustrated in Figure 17 displays the measured elevations with respect to a base elevation of 100 ft and also presents the general shape of the pile. The computed volume of the ore pile is given as 8,078.7 yd^3. A total of four gravity surveys were performed across the width of the ore pile. Each survey line is comprised of 17 to 19 measurement stations of which 9 to 11 locations are positioned on the manganese ore. Equipment malfunction along two of the gravity profiles resulted in suspect data sets. The remaining data sets provided density estimates of the manganese ore of 1.920 and 1.930 g/cm^3. The weight of Pile No. 14, computed by multiplying the density values and measured pile volume, is 26,212,920.0 lbs. The computed weight is approximately 24.8 percent less than the reported weight provided by DNSC as shown in Table 3.

Pile No. 15: Tungsten Ore. The pile of tungsten ore is the smallest pile surveyed at the Sierra Army Depot and is in the shape of a cone as shown in Figure 18. The ore material is also spread unevenly about its base making the base of the pile difficult to determine. The measured elevations, with respect to 100 ft, are contoured and displayed in Figure 19. The estimated volume is 306.8 yd^3. Also unique to this pile is the layout of the gravity survey lines. At each ore pile, the gravity survey lines are laid out parallel to one another except for this pile where the surveys cross and form an 'X' as shown in Figure 19. Referring to the figure, gravity station 9 is at the apex of the pile for both surveys. The average computed density of the tungsten ore determined from the corrected gravity data is 1.99 g/cm^3 which in turn provides an estimated pile weight of 1,029,085.9 lbs (see Table 2). Comparing this weight to the reported gross weight provided by DNSC, the percent difference is approximately -39.5 percent as shown in Table 3.

Pile No. 18A: Chromite Ore. Unlike the other chromite ore piles at the Sierra Army Depot, Pile No. 18A is comprised of refined, fine-grained chromite having the consistency of sand. The reported gross weight of the ore pile as provided by DNSC is 52,131,980 lbs (see Table 1). The results of the topographic survey are presented in the elevation contour map in Figure 20. The estimated volume of the pile, computed from the elevation data, is 13,151.9 yd^3. It should be noted that the boundary of the pile was difficult to differentiate because of the intermixing of the chromite ore and natural sandy soil at the site. Also, along the northern end of the pile, Piles No. 18A and No. 20 have merged which created further difficulties in delineating the actual pile boundary. Three gravity surveys were performed over the pile with 8 to 9 stations positioned on the ore matrical (see Figure 20). Analysis of the corrected gravity data provided a range of computed material densities varying from 2.14 to 2.23 g/cm^3. The average material density is 2.180 g/cm^3 with a standard deviation of 0.039 g/cm^3. The average calculated weight of the chromite ore (see Table 2), computed by multiplying the average bulk density and estimated pile volume, is 48,326,815.5 lbs which is approximately 7.3 percent less than the reported gross weight (see Table 3). The average computed weight has a range of variance of $\pm$820,225.8 lbs.

National Refractory and Mineral Corporation, California

Pile No. 1: Chromite Ore. Pile No. 1, the only pile surveyed at the National Refractory and Mineral Corporation, consists of 61,618,036 lbs of Type B chromite ore as documented by DNSC (see Table 1). The estimated volume of the ore material, as determined from the topographic information, is 12,403.6 yd^3. Three gravity survey lines were performed over the pile as indicated in the elevation contour plot of the ore pile in Figure 21. Each survey line had 10 gravity stations positioned on the ore material. Computed bulk density values range from 2.33 to 3.23 g/cm^3. The average material density over this wide range of values is 2.696 g/cm^3 with a relatively large standard deviation of $\pm$0.386 g/cm^3. Multiplication of the average material density and pile volume (see Table 2) provided an estimated total weight of the chromite ore of approximately 56,365,170.7 lbs. The difference between the average calculated weight in relation to the weight on record (see Table 3) is approximately -8.5 percent.

Hammond Depot, Indiana

Pile No. 12: Ferromanganese. Pile No. 12, as shown in Figure 22, is comprised of cobble to boulder size material classified as high carbon ferromanganese. A close-up view of the ore material was previously shown in Figure 3. A contour map of the ore pile constructed from the measured elevations is presented in Figure 23 and has an estimated volume of 5,353.6 yd^3. The pile is situated on a concrete pad so no material settlement is expected. Three gravity surveys were performed over the pile (see Figure 23). Each survey line has 21 to 22 measurement stations of which 14 are positioned on the ore pile material. Analysis of the corrected gravity data yielded material density values varying from 3.80 to 4.06 g/cm^3. The average computed density of the ferromanganese is 3.903 g/cm^3 with a standard deviation of $\pm$ 0.112 g/cm^3. The estimated weight of Pile No. 12, as listed in Table 3, is 127,743,051.9 lbs with a possible deviation of $\pm$3,665,698.7 lbs. The reported gross weight of 148,812,940 lbs, as provided by DNSC, is approximately 14.1 percent greater than the average calculated weight determined from the gravity data.

Ravenna Army Ammunition Plant, Ohio

Pile No. 8: Chromite Ore. Pile No. 8 is an irregularly shaped pile in that it has two apexes along its length as illustrated in Figure 24. The pile is described by DNSC as Type II chromite ore having a reported weight of 35,557 tons (71,114,000 lbs). An elevation contour plot from the topographic surveys is illustrated in Figure 25 and the estimated volume from that information is 14,289.2 yd^3. Five gravity surveys were performed over the pile as shown in Figure 25 with 11 of the 19 gravity measurements collected directly over the ore material. Computed density values range from 1.98 to

2.49 g/cm³ with an average value of 2.284 g/cm³. The average calculated weight of Pile No. 8 is 55,010,703.7 lbs as indicated in Table 2. The standard deviation of the computed material density values is ±0.182 g/cm³ which reflects an error bound on the weight estimate of ±4,383,515.0 lbs. The computed weight of the chromite ore varies from the reported gross weight by approximately -22.6 percent. It should be noted that upon inspection of the ore pile, evidence suggests material had been removed from the western end of the pile (see Figure 25).

Pile No. 20: Manganese Ore. Pile No. 20 is an elongated pile of Type II manganese ore with a reported gross weight of 13,807 tons (27,614,000 lbs). The western two-thirds of the pile are shown in Figure 26. Inspection of the ore pile prior to the gravity survey suggested that ore had been removed from the eastern one-third of the pile. The contour plot illustrated in Figure 27 displays the measured elevations with respect to a base elevation of 100 ft and also indicates the location of the gravity survey lines. The computed volume of the ore pile, determined from the topographic information, is given as 8,078.7 yd³. Referring to Figure 27, five gravity survey lines were performed across the width of the ore pile. Each survey line is comprised of 20 measurement stations of which 11 locations are positioned on the manganese ore. Equipment malfunction during data acquisition along two of the gravity profiles resulted in suspect data sets. The remaining data sets provided an average material density estimate of 1.800 g/cm³. The computed weight of Pile No. 20 is 25,818,122.3 lbs and is approximately 6.5 percent less than the reported weight provided by DNSC as shown in Table 3.

Pile No. 22: Ferrochrome. Ferrochrome is a refined, metallic product from the processing of chromite ore. Pile No. 22, as shown in Figure 28 (see also Figure 8), is comprised of broken chunks of this material and has a reported gross weight of 26,098 tons (52,196,000 lbs) as listed in Table 1. The material in Pile No. 22 is surrounded by a three foot high wooden barrier and has been placed on a concrete pad. An elevation contour plot of the pile is illustrated in Figure 29 and the estimated volume is 7,458.9 yd³. Three gravity survey lines traversed the ore pile with 9 to 10 measurement stations positioned on the ferrochrome material as shown in Figure 29. Analysis of the corrected gravity values provided density estimates ranging from 3.63 to 4.04 g/cm³. The average material density is 3.843 g/cm³ with a standard deviation of ±0.168 g/cm³. The average calculated weight of the pile is 48,315,708.8 lbs with a possible deviation of ±2,112,162.1 lbs. Comparing the average computed weight to the reported weight provided by DNSC, a difference of -7.4 percent exists as shown in Table 3.

Somerville Depot, New Jersey

Pile No. 1: Chromite Ore. Pile No. 1 at the Somerville Depot is an L-shaped pile classified as chemical grade chromite ore with a reported gross weight, as provided by DNSC, of 35,197 tons (70,394,000 lbs) as listed in

Table 1. The composition of the chromite ore is similar to that of Pile No. 18A at the Sierra Army Depot in which the ore is refined, fine-grained material having the consistency of sand. There is a wooden barrier along two sides of the ore pile. The results of the topographic survey are presented in an elevation contour map of the pile in Figure 30 using a reference elevation of 100 ft. The estimated volume of the pile, computed from the elevation data, is 13,010.3 yd^3. Three gravity surveys were performed over the pile as shown in Figure 30. At the widest section of the pile, 13 gravity stations were placed on the ore material whereas over the narrower section, 11 stations were situated on the pile. Four gravity stations along each line were located off the ore material on either side of the pile. Analysis of the corrected gravity data provided a range of computed material densities varying from 2.90 to 3.12 g/cm^3. The average density value is 2.993 g/cm^3 with a standard deviation of 0.093 g/cm^3. Multiplying the average density and estimated pile volume, the average calculated weight of the chromite ore (see Table 2) is 65,635,260.6 lbs which is approximately 6.7 percent less than the reported gross weight as listed in Table 3. The average computed weight has a range of variance of $\pm$2,039,451.8 lbs.

Summary of Results

Comparing the computed weights for each ore stockpile to the reported weights provided by DNSC, it is observed that all of the calculated results, with one exception, are less than those on record. The one exception was Pile No. 6 at the Sierra Army Depot, CA where material from another pile had been placed next to this pile and thereby masking the original pile outline. The less than reported values seem reasonable considering the scatter of ore material near the base of many piles, settlement of the ore material not detected by the topographic or gravity surveys, difficulties in differentiating the true base of each pile, inhomogeneities within the ore creating highly variable density estimates, and possible removal of material at some piles. Poor differentiation of the intricate geometries of some piles and suspect gravity data sets in some instances have also be a contributing factor. A comparison of the percent differences between the reported and computed weights for the 14 ore piles are summarized as follows:

Number of Piles	Difference Range
6	0 - 10 %
1	10 - 15 %
2	15 - 20 %
2	20 - 25 %
3	> 25 %

The percent differences computed for seven of the piles were within the expected error range of 10 to 14 percent outlined prior to the survey. The piles having the greatest percent differences, greater than 20 percent, may

attribute these discrepencies based on any of the following reasons: pile boundaries could not be defined accurately, ore material scattered about the base could not be easily incorporated into the study, equipment problems such as jarring of the instrument or low battery output produced suspect data sets, or the possibility that ore material had been removed since placement. The highest percent difference, -40.5 percent, was computed for Pile No. 1 at the Sierra Army Depot, CA in which the estimated weight of the ore material is 7,009,893.2 lbs. As mentioned in the discussion of results, this pile has since been removed and the actual weight of the material is approximately 9,000,000 lbs; a percent difference of 22.1 from the calculated weight. Therefore, it is possible that the reported weights for many of the piles may also be inaccurate. Removal of the pile also indicated that the ground beneath the ore pile had settled approximately 1 to 2 ft since placement. Since the volume of the ore stockpile, computed from the topographic survey data, is unable to account for the volume of material below the ground surface, the computed weight represents the "above ground surface" weight.

The highest percent differences overall were computed at the Sierra Army Depot, CA where the piles are located on unprepared, sandy soil. Settlement of the sandy soil beneath the ore material or an irregular original placement surface is likely to have contributed to the higher than expected computed differences. Some concern had arisen prior to the gravity survey that some of the ore piles may have settled 3 to 5 ft below the original surface plane. Using the computer algorithm denoted as method three earlier, no significant indications of material settlement were detected at any of the pile locations. For instance, the material comprising Pile No 18A, the largest pile at the site, was found to have possibly settled 1 to 2 ft. However, the confidence in the results is limited considering the finite number of gravity data points over the ore pile. However, when Pile No. 1 was removed from the site, it was found to have settled 1 to 2 ft near the center of the pile. On a related note, the piles at the Sierra Army Depot are located in a desert environment and it is possible that a decrease in the moisture content of the material since placement could have an effect on the current weight estimates.

It is also of interest to note similarities between piles of similar ore material, pile locales, and placement characteristics. The average densities of the eight chomite ore piles surveyed ranged from 2.063 to 2.993 g/cm^3. The three manganese ore piles had computed material densities ranging from 1.795 to 2.005 g/cm^3. Two piles of processed ore, one each at the Hammond Depot, IN and Ravenna Army Ammunition Plant, OH, were situated on concrete pads to prevent settlement of the ground beneath the ore material; the computed differences for these piles were -14.1 and -7.4 percent, respectively. Four ore piles were placed on prepared, natural earth surfaces; three of these had computed differences ranging from -6.5 to -8.5 percent. The remaining pile of the four, located at the Ravenna Army Ammunition Plant, OH, has a computed difference of -22.6 percent but it is suspected that material has been removed from the pile since placement.

4 Conclusions

The Defense National Stockpile Center (DNSC) of the Defense Logistics Agency maintains stockpiles of high-grade ores at various defense depots throughout the country. DNSC has a requirement to produce current mass estimates for fourteen statistically selected piles as part of a national audit. The fourteen piles selected are located at the: Sierra Army Depot and National Refractory and Mineral Corporation, California; Hammond Depot, Indiana; Ravenna Army Ammunition Plant, Ohio; and Somerville Depot, New Jersey. The pile materials are all heavy metal ores consisting of either chromite, manganese, tungsten, ferrochrome, or ferromanganese. While the initial, as-delivered weights of the stockpiles are known or have been previously estimated, many of the estimates are 30 to 40 years old and may not be reliable.

Microgravity measurements were performed over each ore pile to provide high-resolution surveys of the gravitational field with which to determine the average bulk density of the ore material. Each microgravity survey line consists of approximately 17 to 21 measurement stations oriented perpendicular to the strike or long axis of the ore pile. Nine to 11 of the measurement stations are located on the ore material and it is these stations from which the gravity anomaly is determined and material densities derived. Depending on the dimensions of each ore pile, two to five gravity survey lines are performed and each line has a base station to which all elevations and gravity measurements are referenced. Implementing the necessary gravity corrections for the effects due to latitude, elevation, topography, and instrument drift, the measured values are corrected to the base station reference datum. In this manner, variations in the corrected gravity values are assumed to be due solely to the ore pile material.

Analysis of the gravity anomaly data was completed through the use of both Nettleton's and Parasnis' method. Each of these methods computes, for the two to five survey lines conducted over an ore pile, the same number of spatially distributed, volume-averaged bulk density values for ore pile material. The bulk density values are averaged to determine a single, in-place density value for the ore with computed standard deviations to reflect the confidence interval of the result. These methods have the advantage of averaging the effect of density variations more accurately than can be done from surface

or core samples. A third method used to determine the material density is a two-and-a-half dimensional gravity modeling routine which allows investigation of possible settlement of the ore pile. The pile density determination accuracy is estimated to be approximately $\pm$ 0.2 g/cm^3 (12.5 lb/ft^3).

Topographic surveys to compute the volumes of the ore stockpiles were completed using standard land surveying methods. The topographic survey program took into account all ridges, depressions, and other significant characteristics on the surface of the stockpiles. The base of each pile is determined by a planar surface passing through the elevation points along the toe of the pile. Volumes were computed from three-dimensional pile representations and estimated to be within five percent of the actual value. It should be noted that any ore material below the planar surface, due to pile settlement or an irregular, original placement surface, is not included in the pile volume determination and, hence, the ore stockpile weight.

Comparing the gravimetrically derived weights for each ore stockpile to the reported weights provided by DNSC, it is observed that all of the calculated results, with one exception, are less than those on record. The less than reported values seem reasonable considering the scatter of ore material near the base of many piles, settlement of the ore material not detected by the topographic or gravity surveys, difficulties in differentiating the true base of each pile, inhomogeneities within the ore creating highly variable density estimates, and possible removal of material from some piles. The percent differences computed for seven of the piles were within the expected error range of 10 to 14 percent.

The highest percent differences overall were computed at the Sierra Army Depot, CA where the piles are located on unprepared, sandy soil. Upon removal of Pile No. 1, the measured weight of the ore was found to be approximately 2,800,000 lbs less than the originally reported weight and the pile had settled 1 to 2 ft below the current ground surface near the center of the pile. Both of these factors, erroneous reported weights and material settlement, are contributors to the higher than expected percent differences. Ore stockpiles situated on prepared surfaces or concrete pads typically have computed differences less than 10 percent. Comparing the results of similar ore material, the average densities of the eight chomite ore piles surveyed ranged from 2.063 to 2.993 g/cm^3 whereas the three manganese ore piles had computed material densities ranging from 1.795 to 2.005 g/cm^3.

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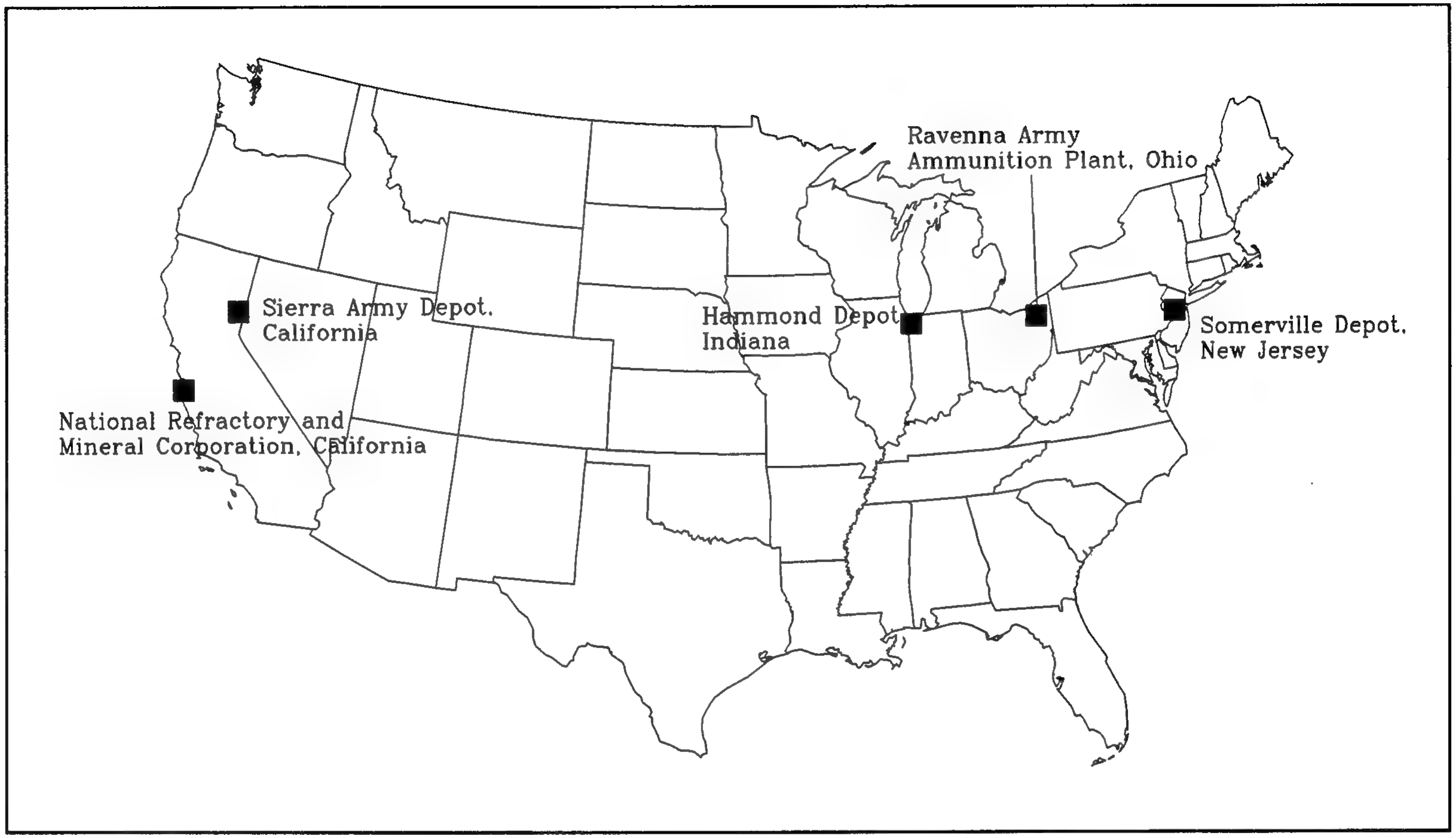


Figure 1. Location of test sites

Figure 2. LaCoste & Romberg Model D gravity meter on base plate

Figure 3. Microgravity measurement station

Figure 4. Microgravity stations located off ore pile

Figure 5. Microgravity stations positioned on ore pile

Figure 6. Microgravity measurements at base station

Figure 7. Microgravity measurements near ore stockpile

Figure 8. Microgravity measurements on side slope of ore pile

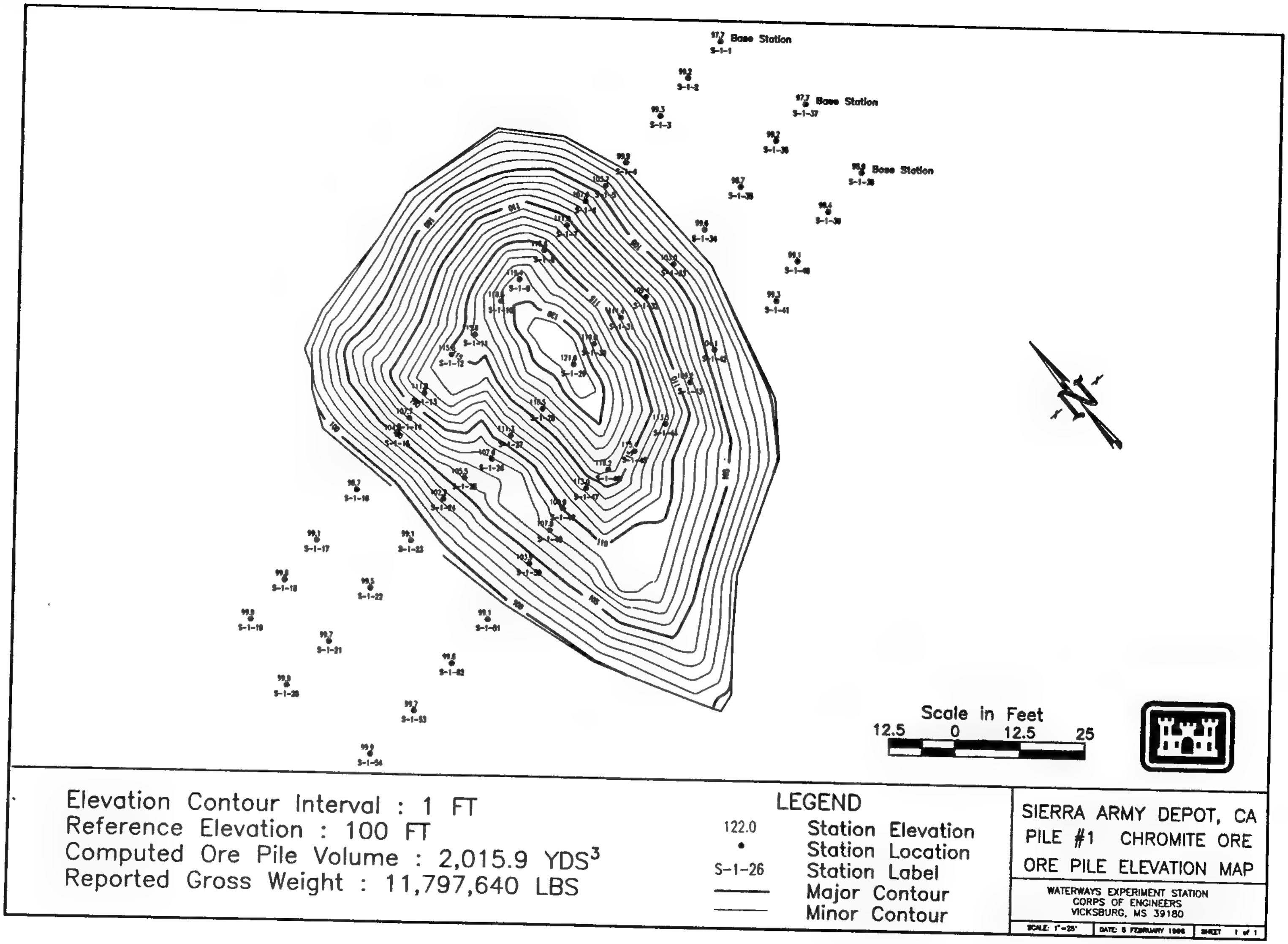


Figure 9. Elevation contour map of Pile #1, Sierra Army Depot, CA

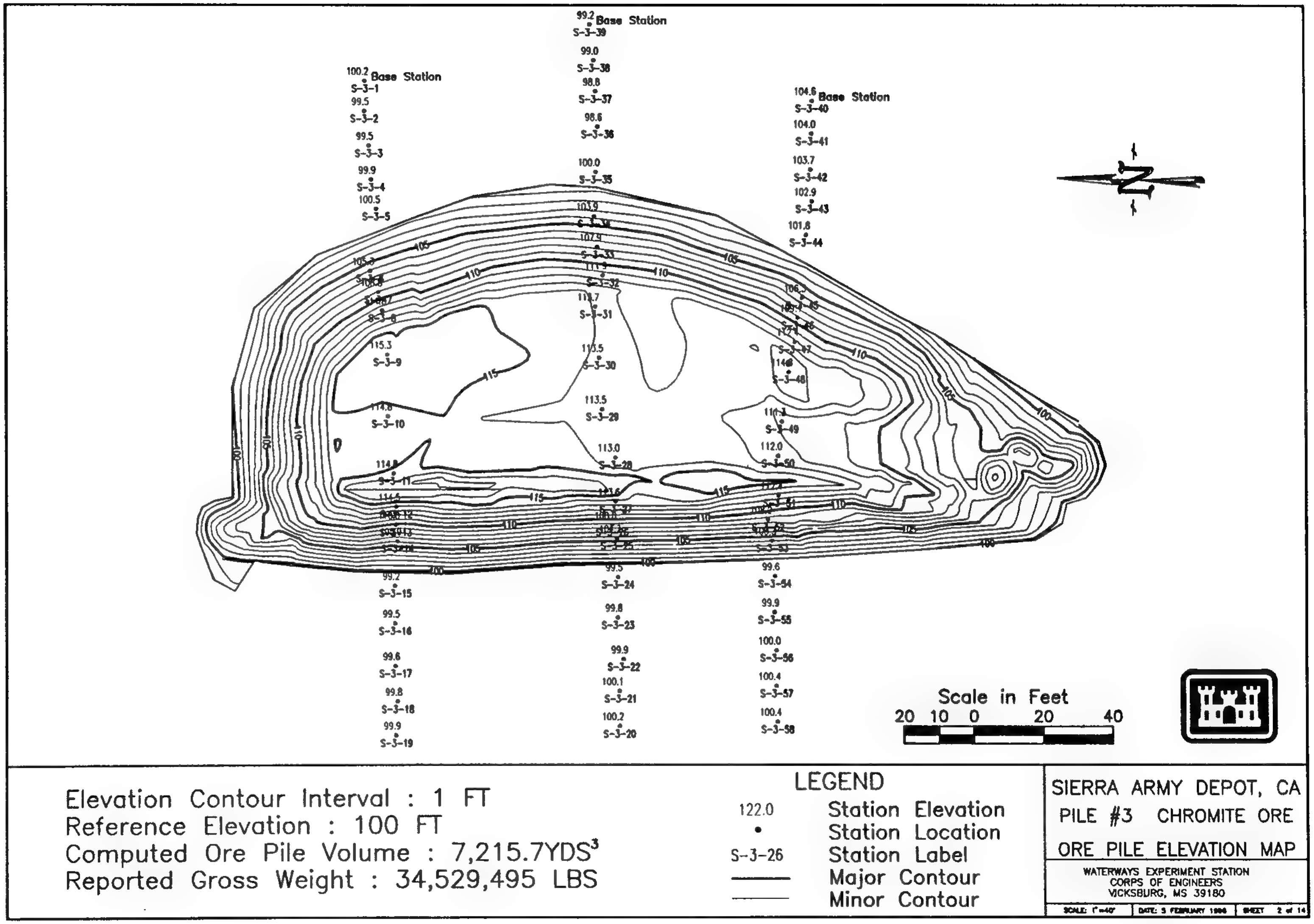


Figure 10. Elevation contour map of Pile #3, Sierra Army Depot, CA

Figure 11. Pile #5, Sierra Army Depot, CA

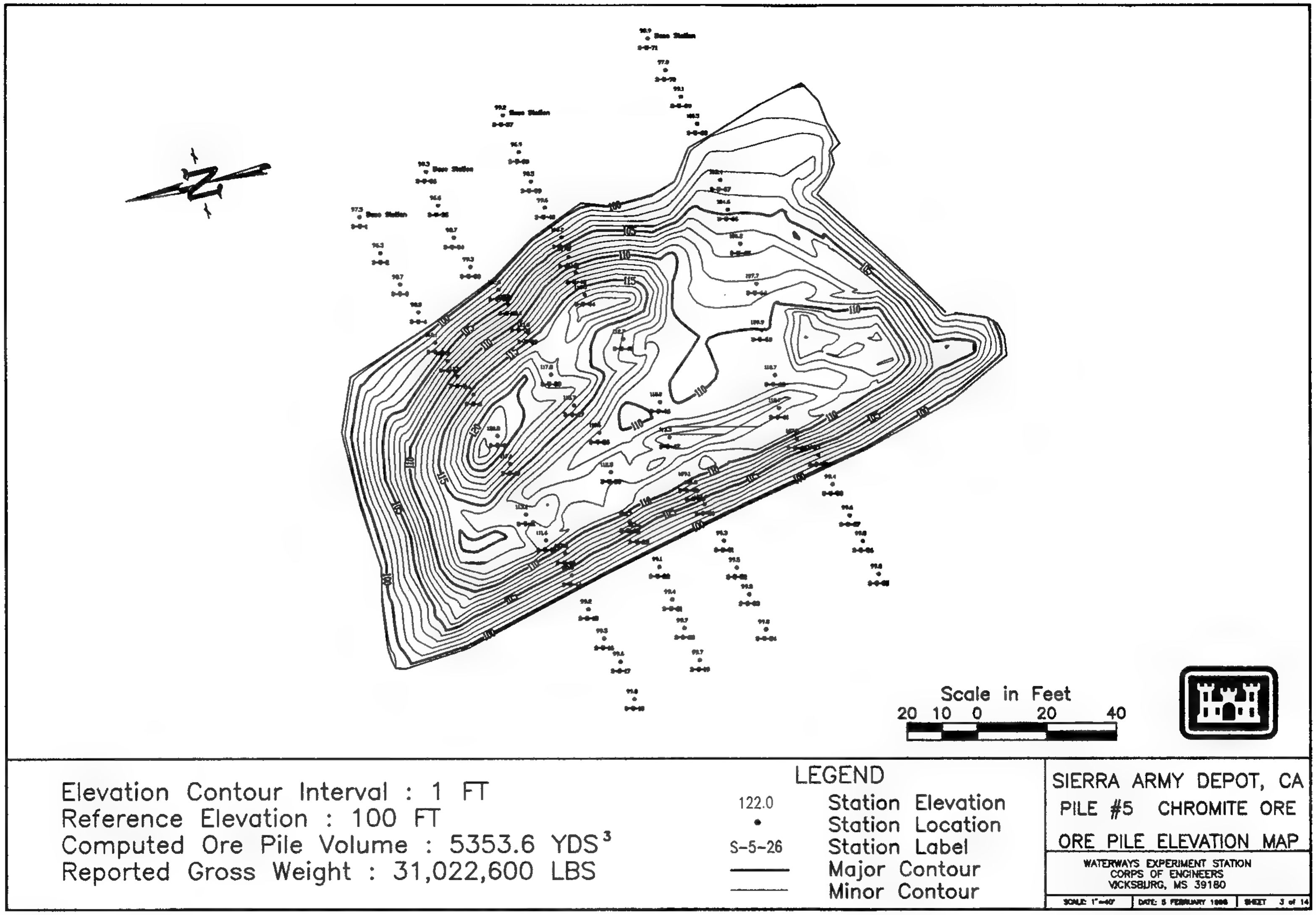


Figure 12. Elevation contour map of Pile #5, Sierra Army Depot, CA

Figure 13. Pile #6, Sierra Army Depot, CA

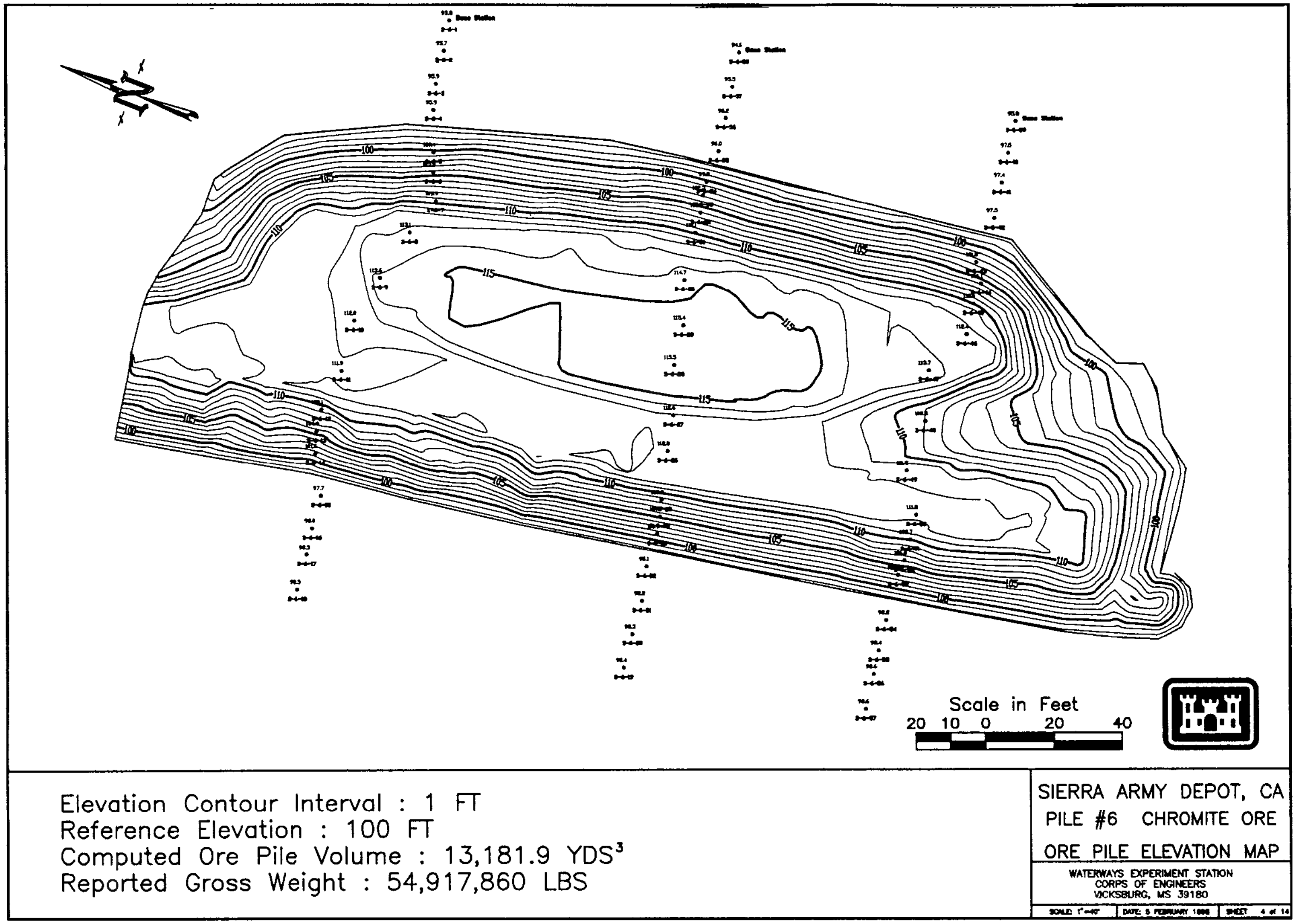


Figure 14. Elevation contour map of Pile #6, Sierra Army Depot, CA

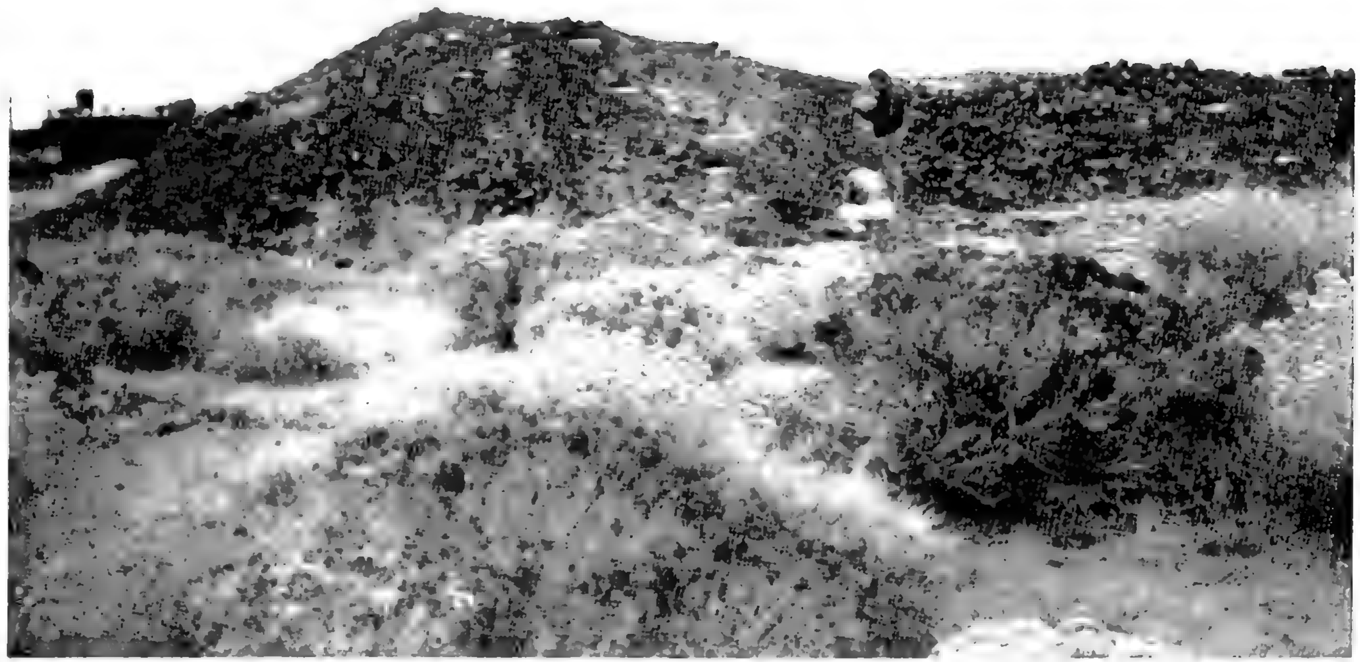


Figure 15. Pile #10, Sierra Army Depot, CA

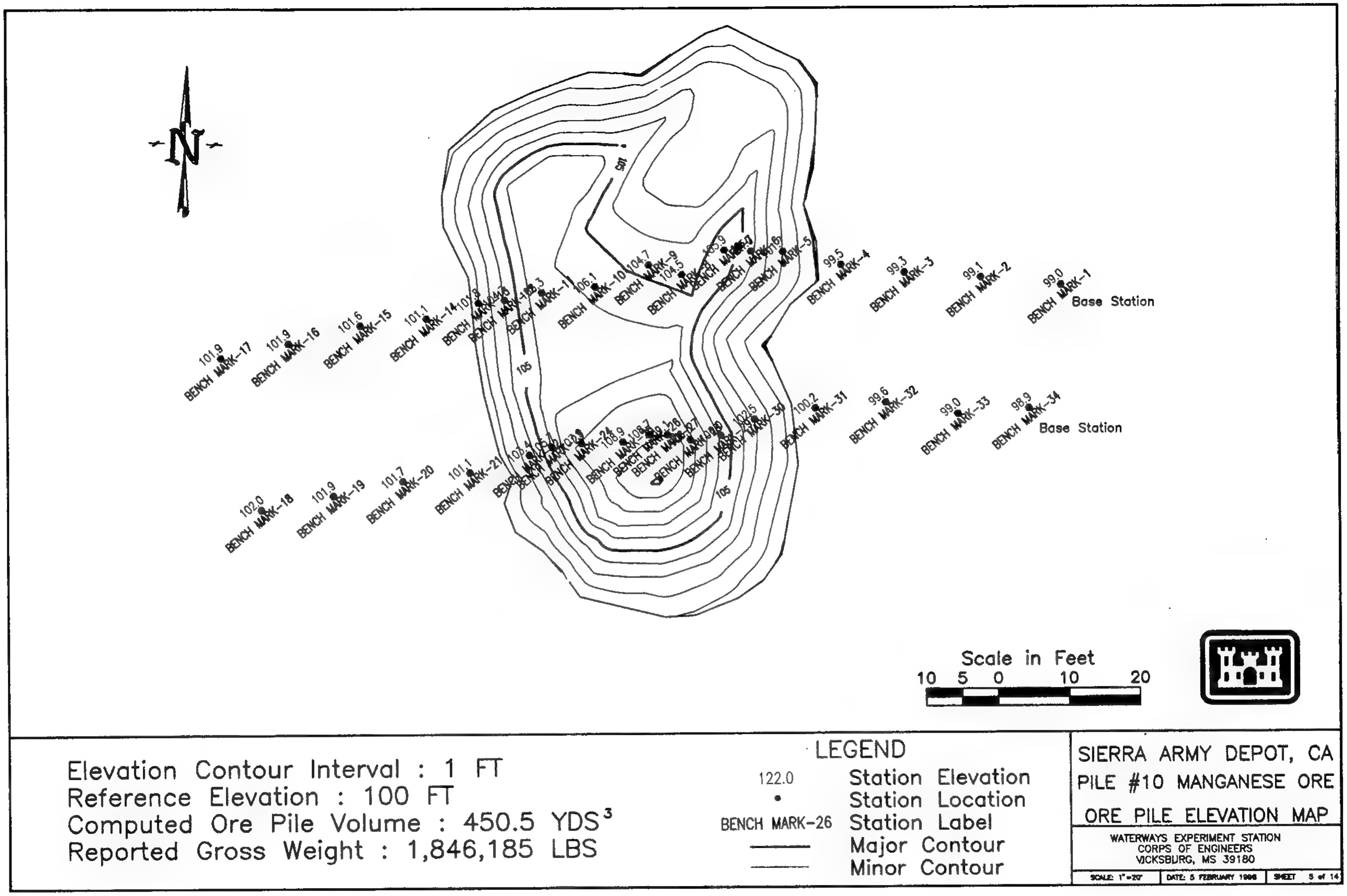


Figure 16. Elevation contour map of Pile #10, Sierra Army Depot, CA

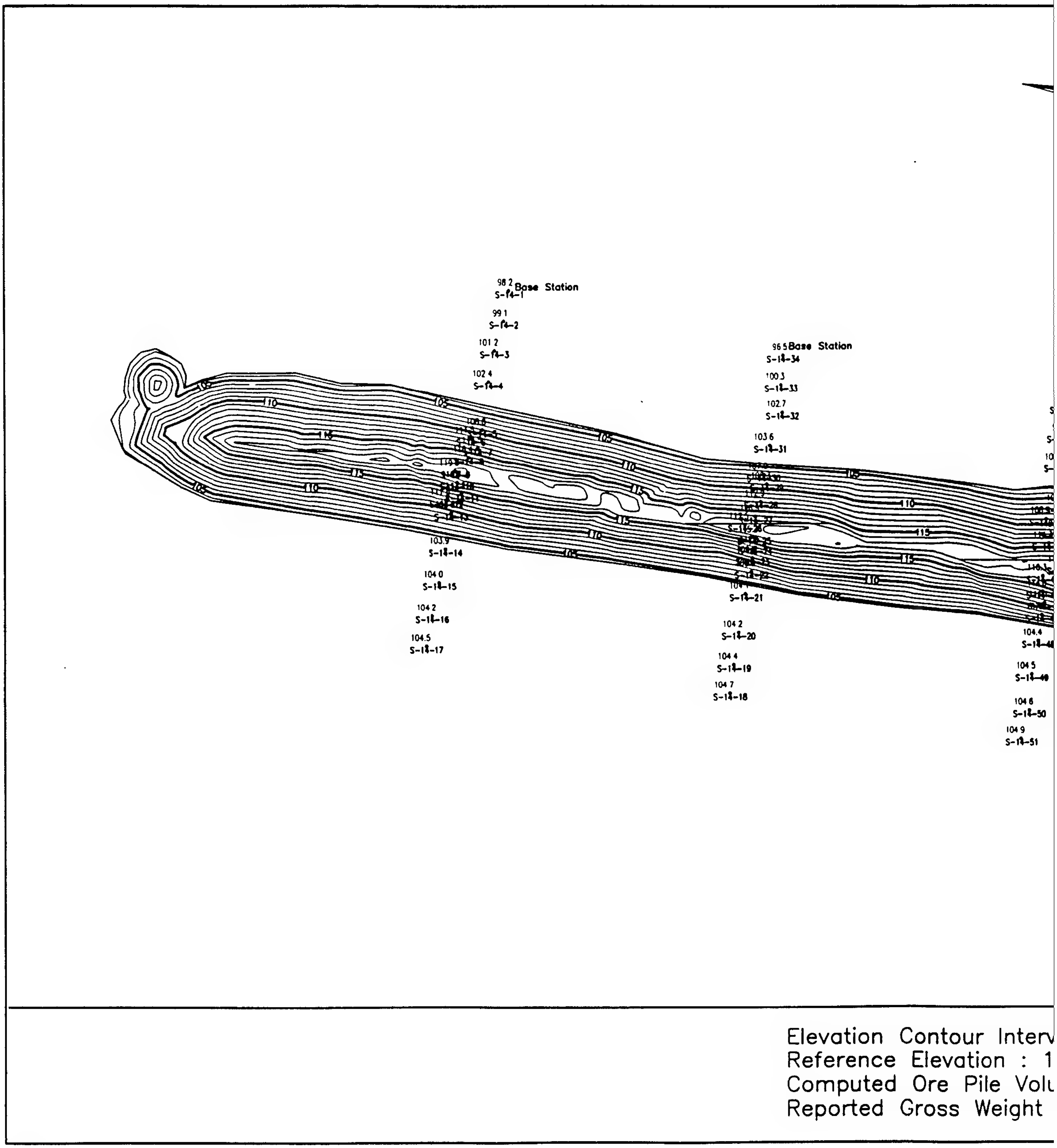
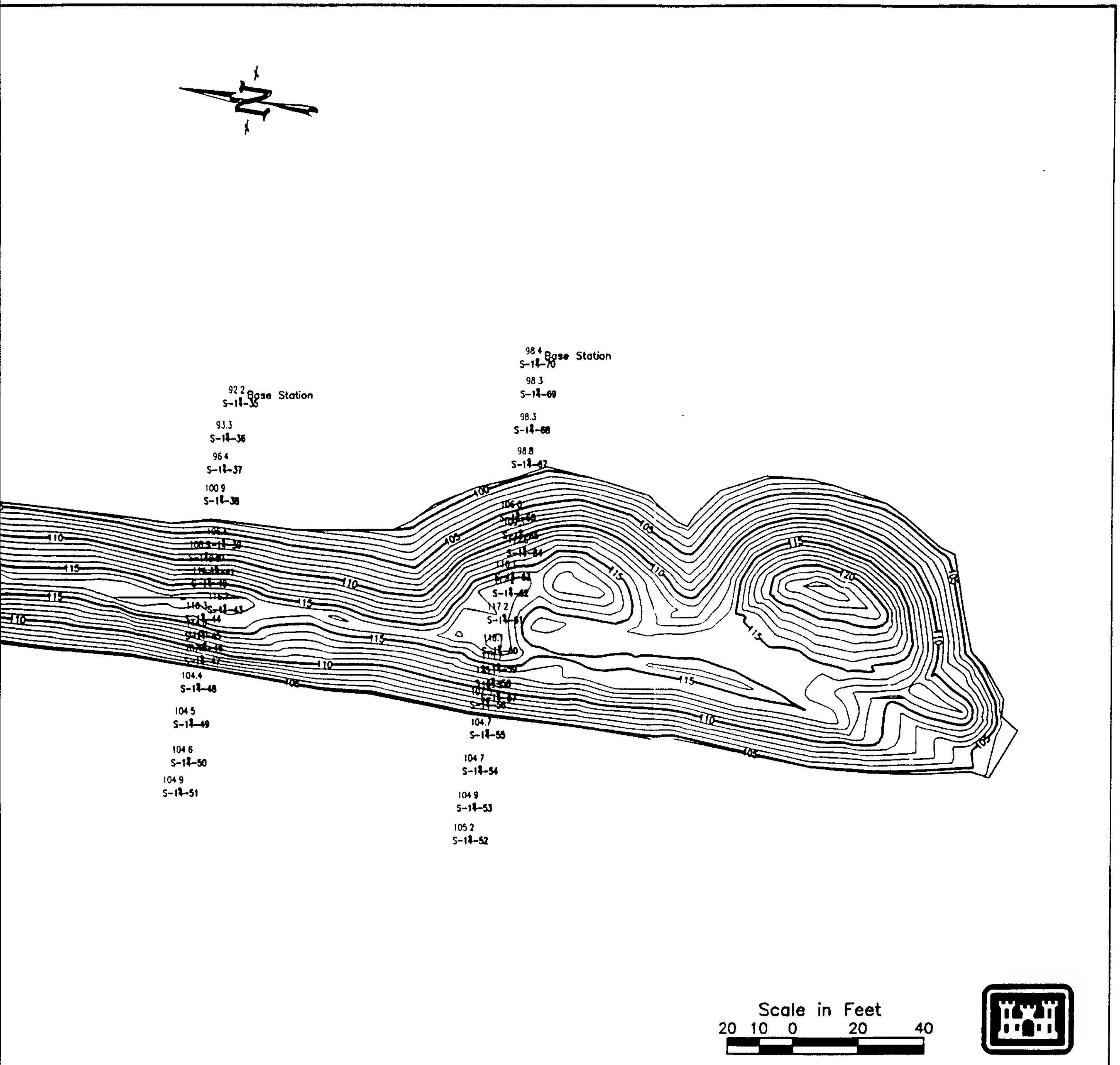


Figure 17. Elevation contour map of Pile #14, Sierra Army Depot, CA



ion Contour Interval : 1 FT
ence Elevation : 100 FT
uted Ore Pile Volume : 8,078.7 YDS^3
ted Gross Weight : 34,869,960 LBS

LEGEND

122.0	Station Elevation
•	Station Location
S-14-26	Station Label
———	Major Contour
———	Minor Contour

SIERRA ARMY DEPOT, CA
PILE #14 MANGANESE ORE
ORE PILE ELEVATION MAP

WATERWAYS EXPERIMENT STATION
CORPS OF ENGINEERS
VICKSBURG, MS 39180

SCALE: 1"=40' | DATE: [illegible] | SHEET [illegible] of 14

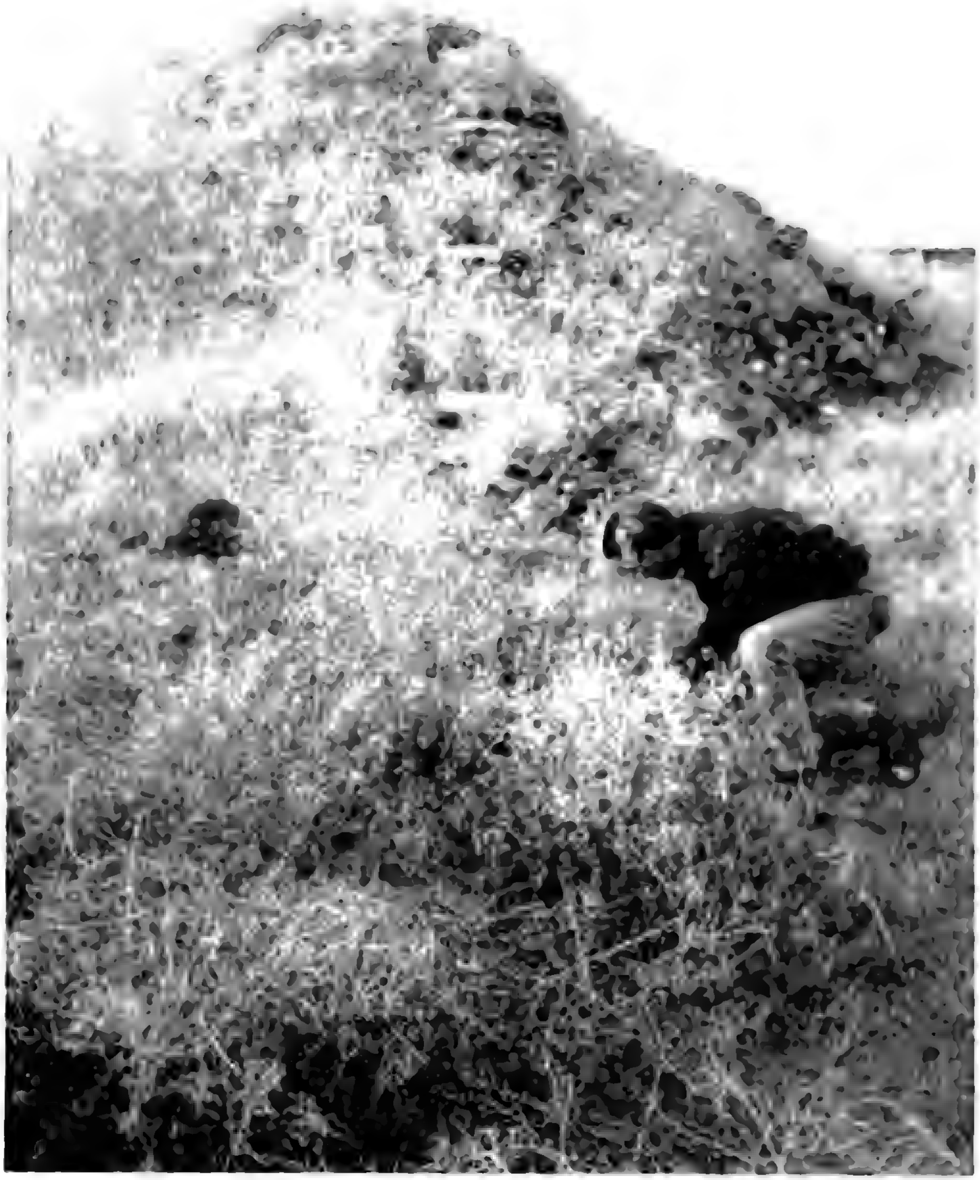


Figure 18. Pile #15, Sierra Army Depot, CA

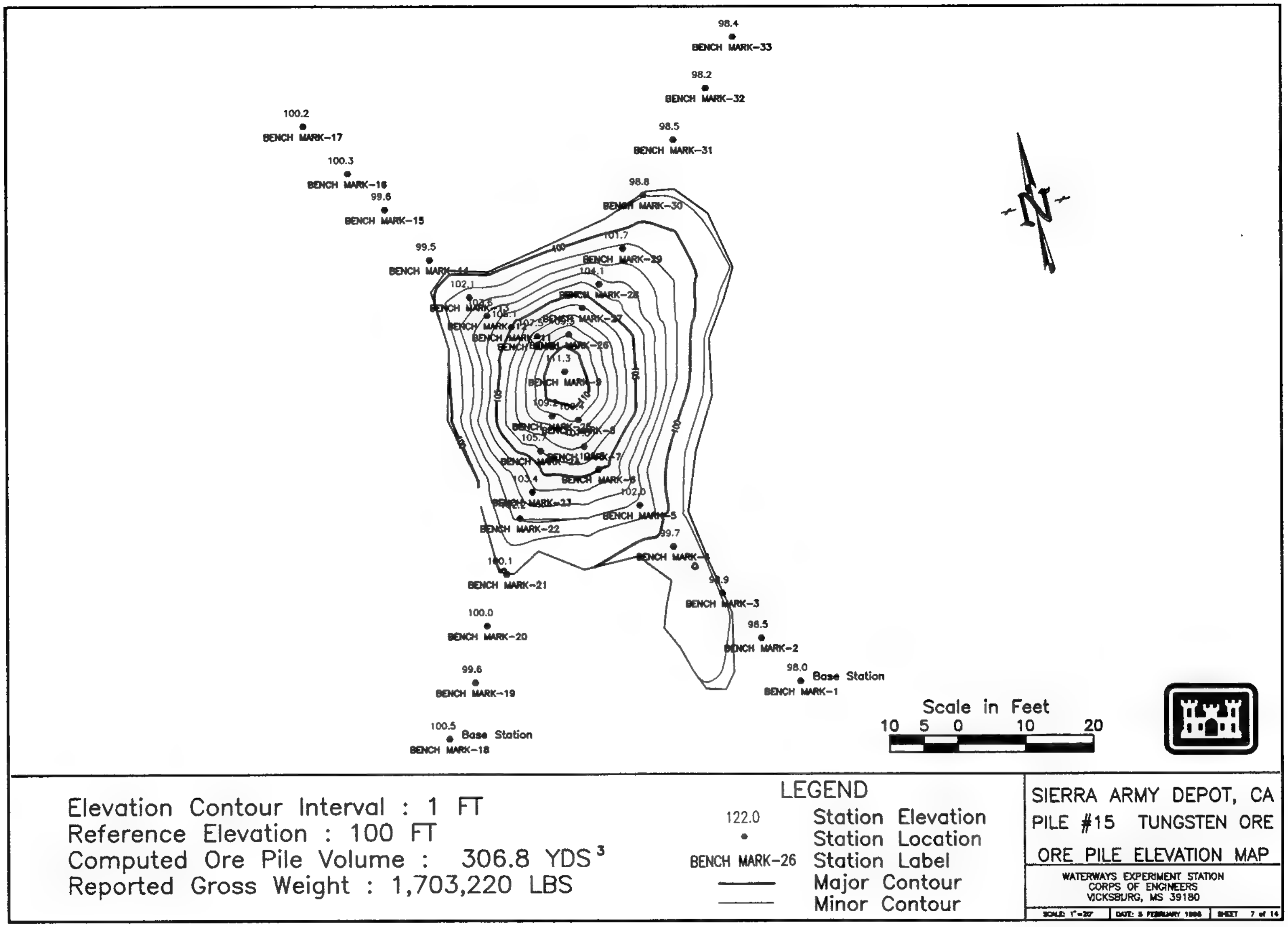
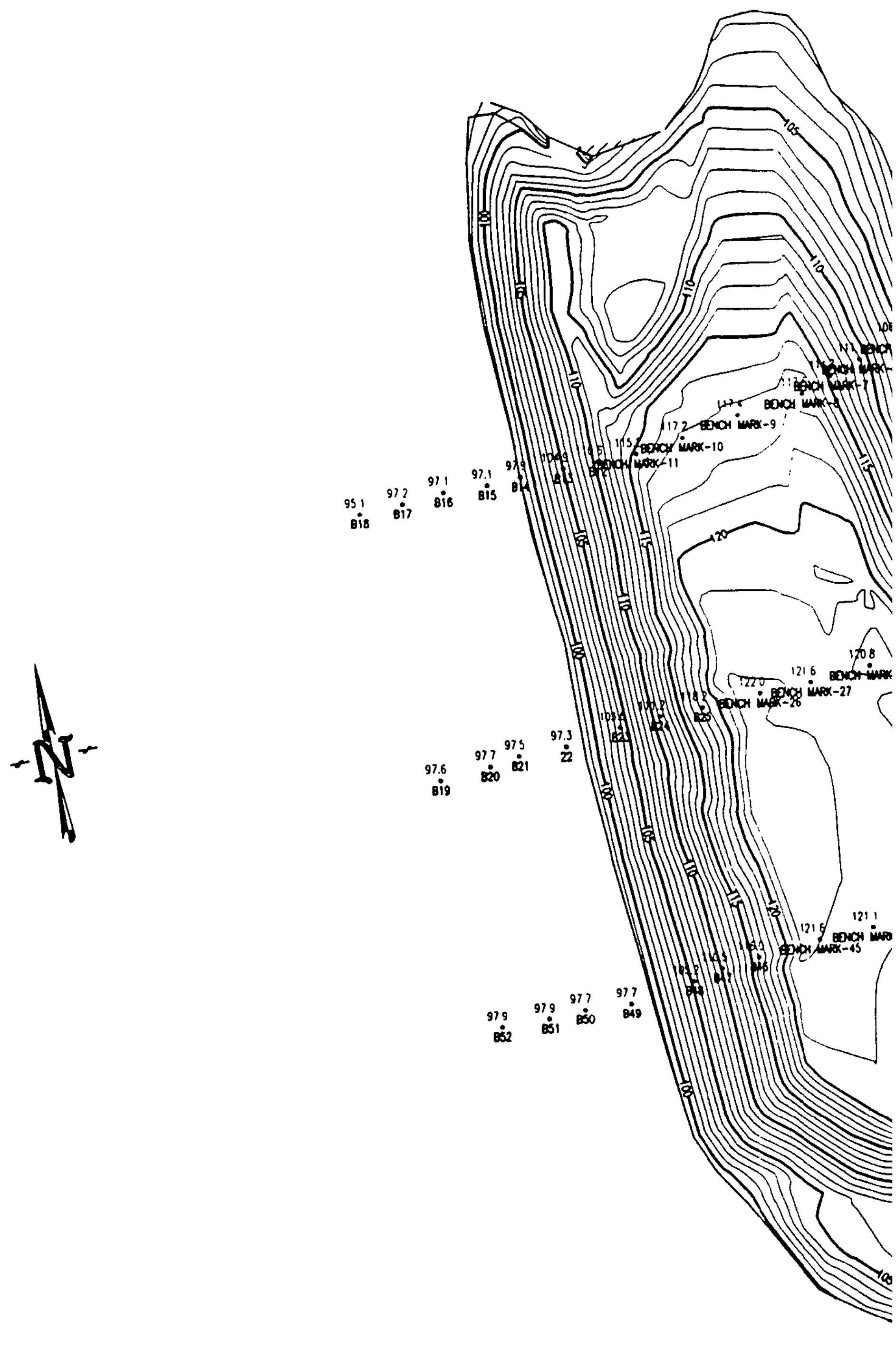


Figure 19. Elevation contour map of Pile #15, Sierra Army Depot, CA



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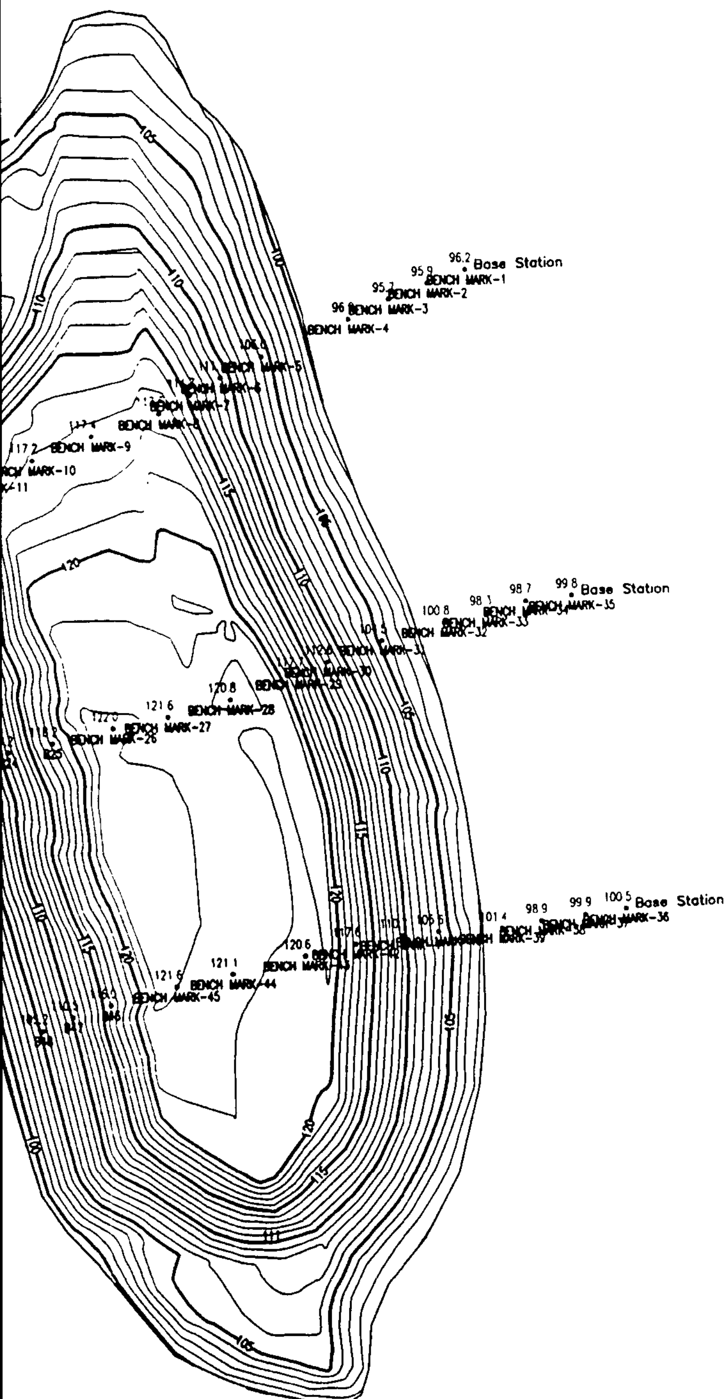
Reference Elevatio
Computed Ore Pile
Reported Gross We

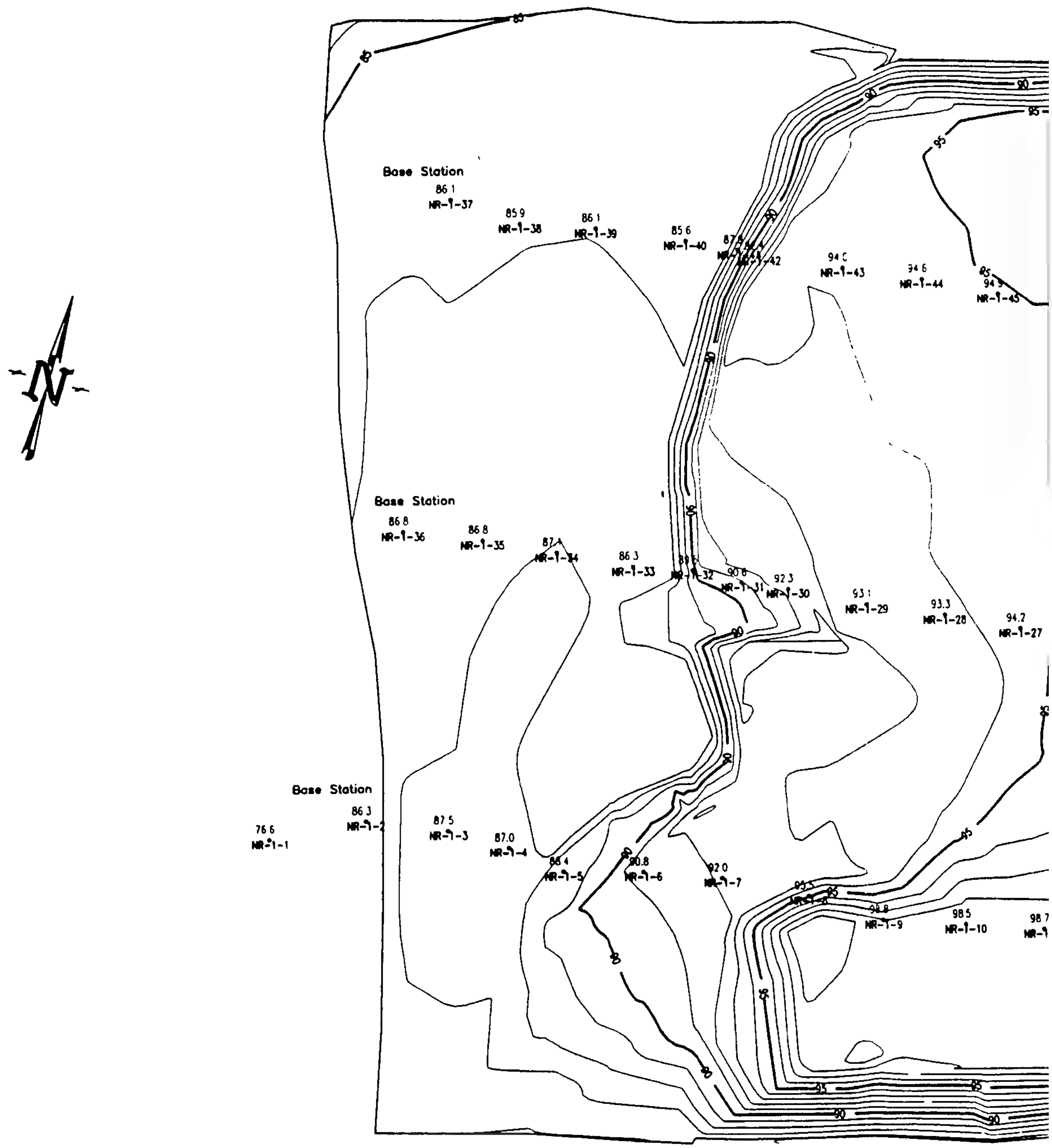
Figure 20. Elevation contour map of Pile #18A, Sierra Army Depot, CA



Scale in Feet

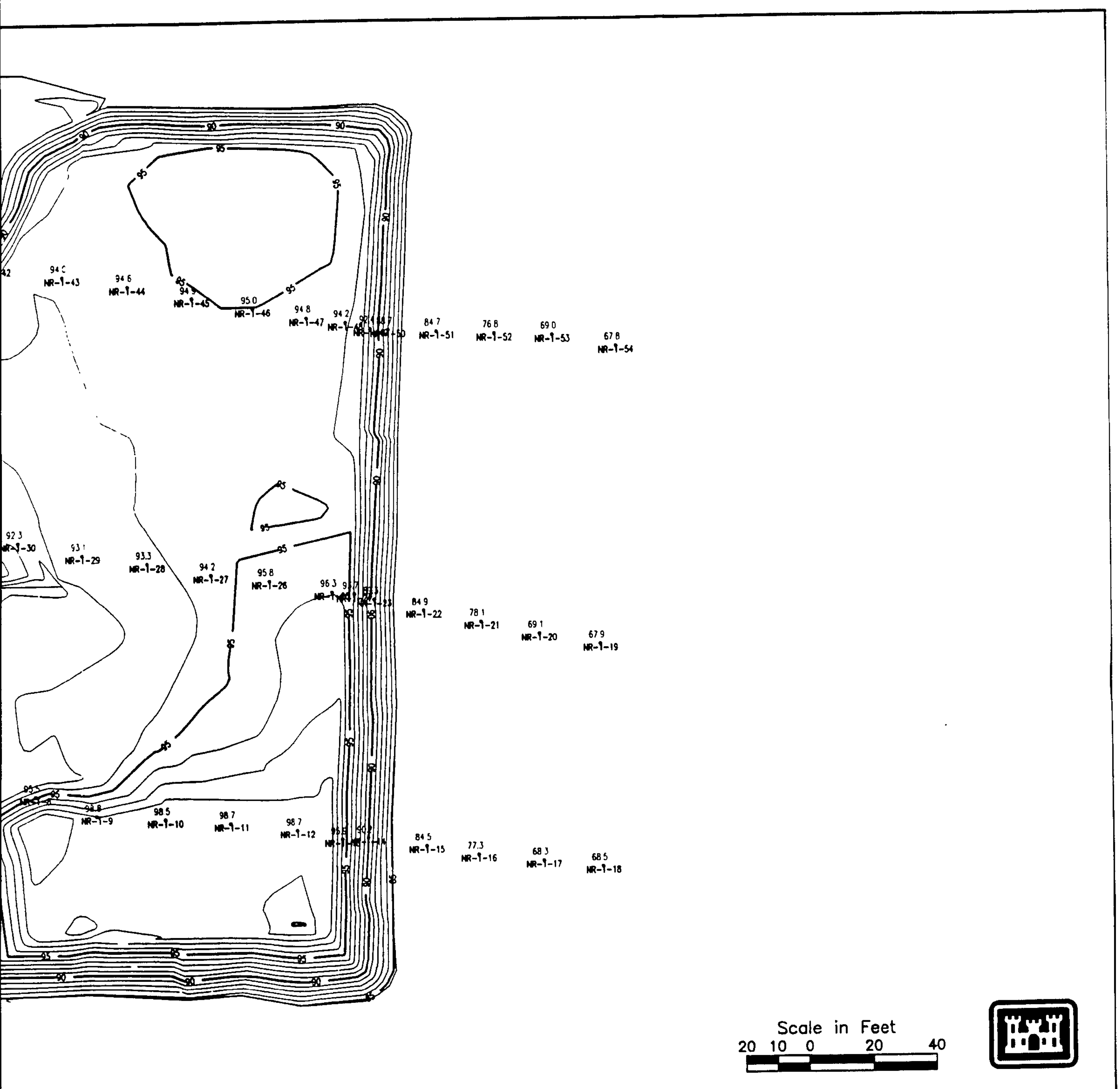
20 10 0 20 40

...vation Contour Interval : 1 FT	LEGEND	SIERRA ARMY DEPOT, CA
...erence Elevation : 100 FT	122.0 Station Elevation	PILE #18A MANGANESE ORE
...nputed Ore Pile Volume : 13,151.9 YDS^3	• Station Location	ORE PILE ELEVATION MAP
...orted Gross Weight : 52,131,980 LBS	BENCH MARK-26 Station Label	WATERWAYS EXPERIMENT STATION CORPS OF ENGINEERS VICKSBURG, MS 39180
	—— Major Contour	SCALE: 1"=40' | DATE: 8 FEBRUARY 1996 | SHEET 8 of 14
	—— Minor Contour	



Elevation Contour Inte
Reference Elevation :
Computed Ore Pile Vo
Reported Gross Weigh

Figure 21. Elevation contour map of Pile #1, National Refractory and Mineral Corporation, CA



vation Contour Interval : 1 FT
ference Elevation : 85 FT
mputed Ore Pile Volume : 12,403.6 YDS^3
ported Gross Weight : 61,618,036 LBS

LEGEND

122.0	Station Elevation
•	Station Location
NR-1-26	Station Label
———	Major Contour
———	Minor Contour

NATIONAL REFRACTORY & MINERAL CORP., CA

PILE #1 CHROMITE ORE
ORE PILE ELEVATION MAP

WATERWAYS EXPERIMENT STATION
CORPS OF ENGINEERS
VICKSBURG, MS 39180

SCALE: 1"=40' | DATE: 5 FEBRUARY 1996 | SHEET 8 of 14

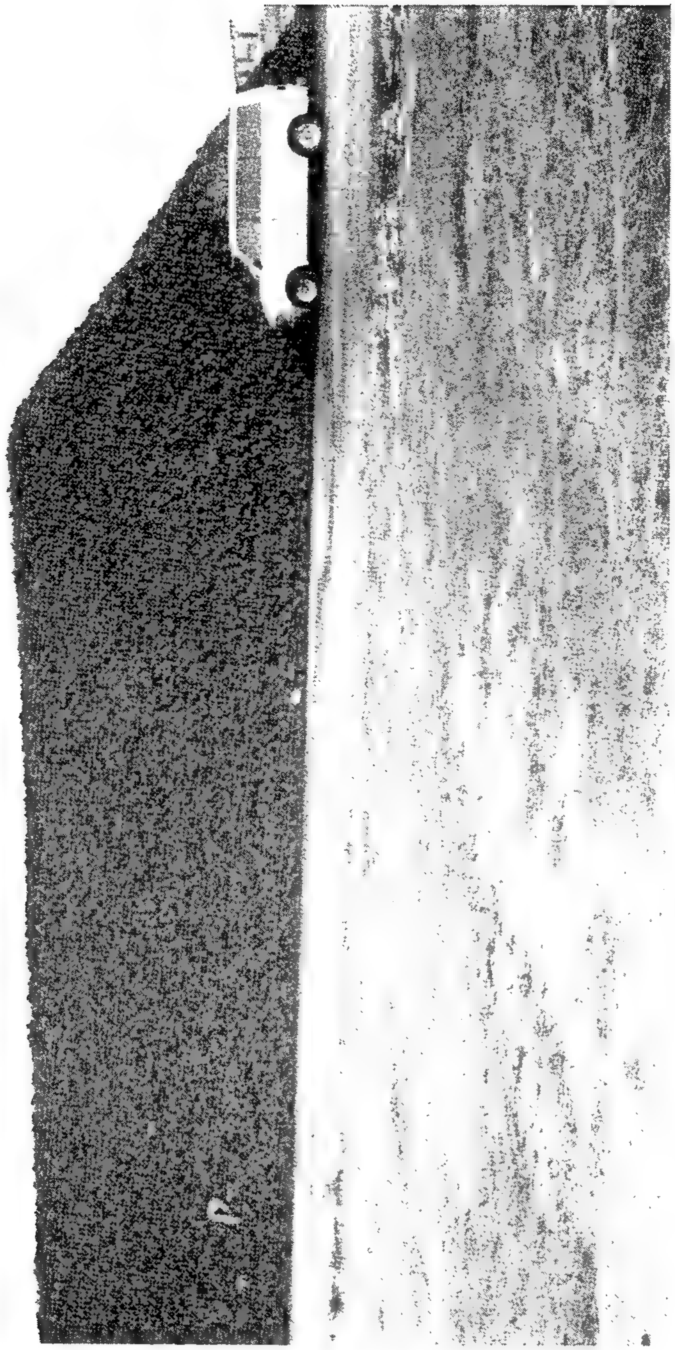
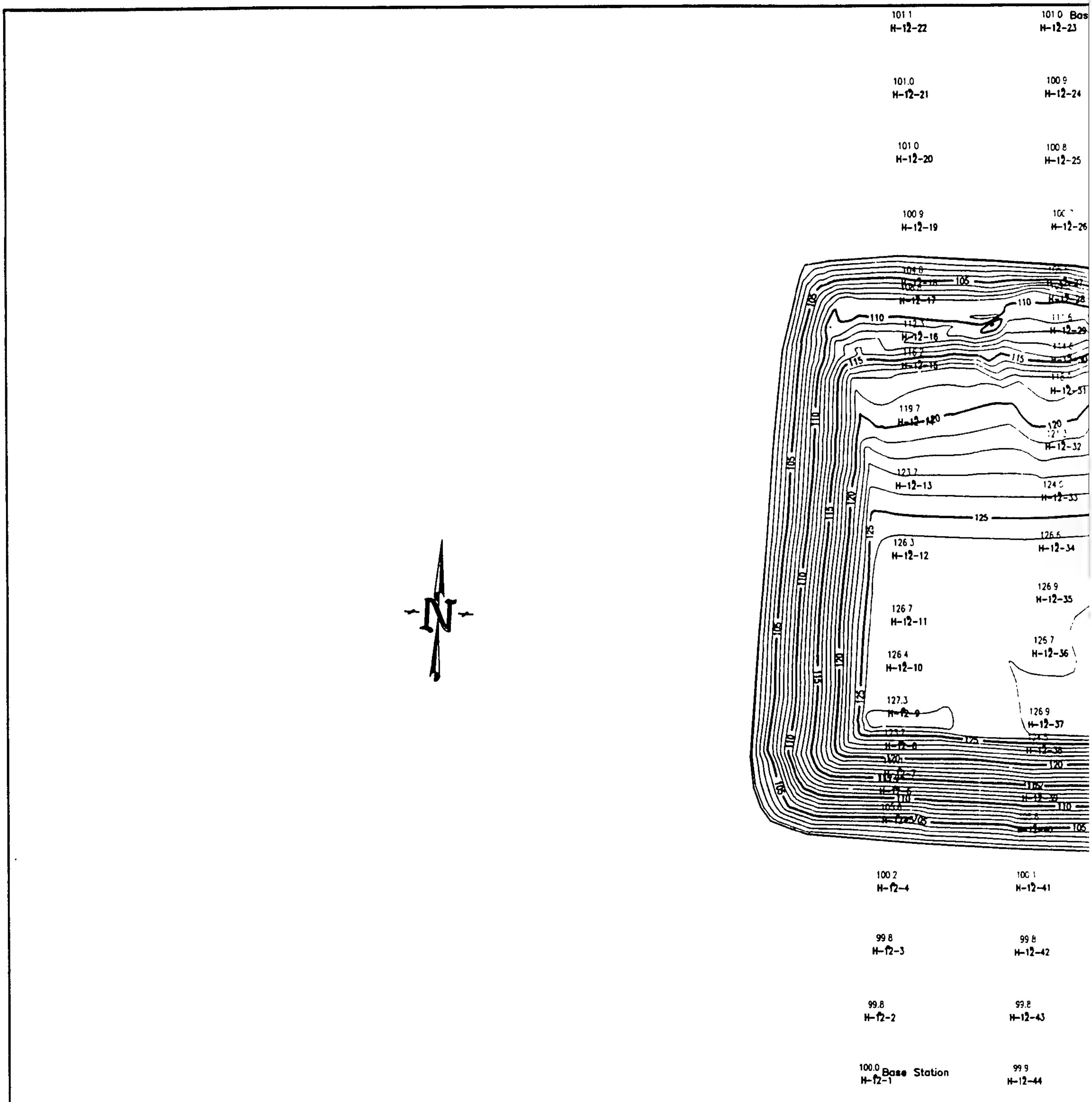
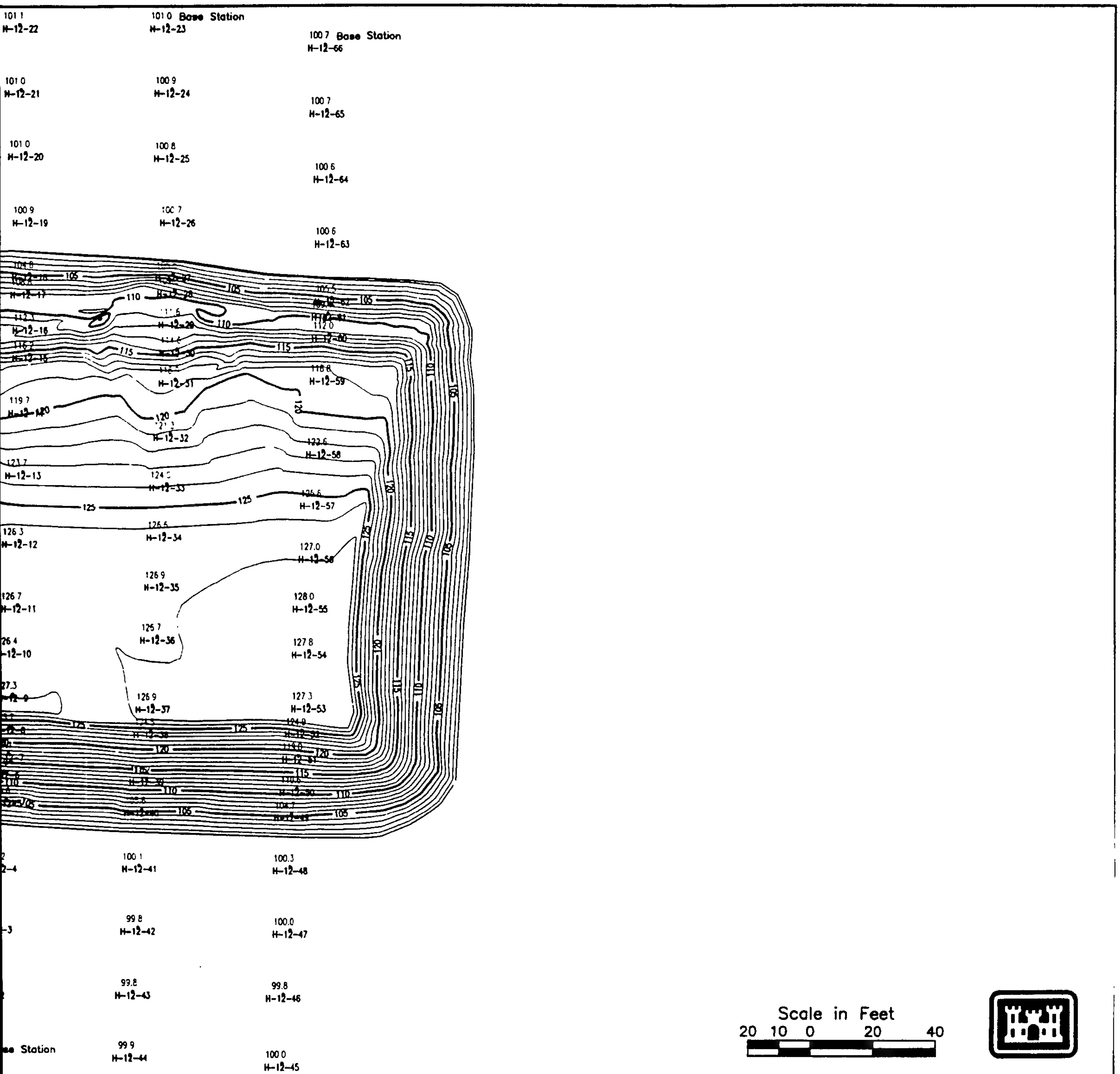


Figure 22. Pile #12, Hammond Depot, IN



Elevation Contour
Reference Elevatior
Computed Ore Pile
Reported Gross We

Figure 23. Elevation contour map of Pile #12, Hammond Depot, IN



vation Contour Interval : 1 FT
ference Elevation : 100 FT
mputed Ore Pile Volume : 19,417.6 YDS³
ported Gross Weight : 148,812,940 LBS

LEGEND

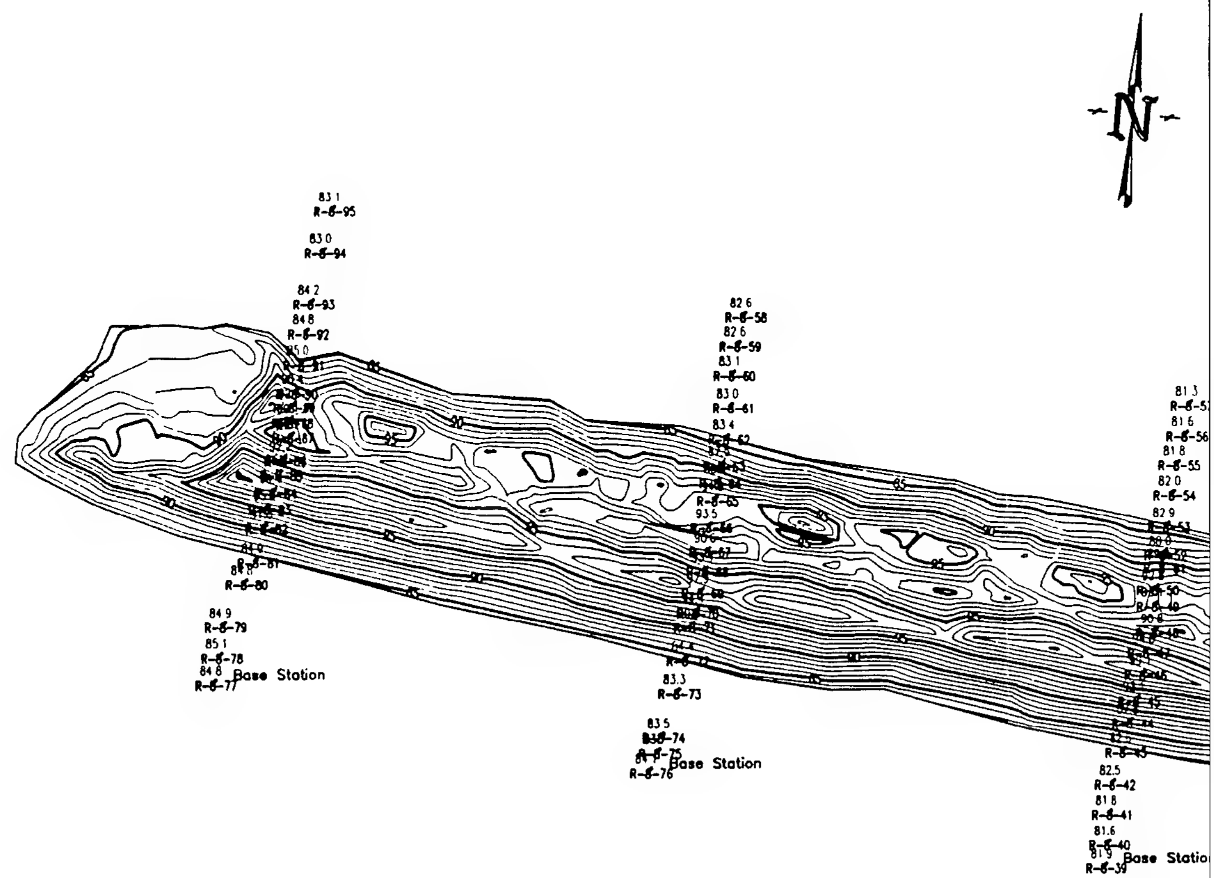
122.0	Station Elevation
•	Station Location
H-12-26	Station Label
———	Major Contour
———	Minor Contour

HAMMOND ARMY DEPOT, IN
PILE #12
FERROMANGANESE
ORE PILE ELEVATION MAP

WATERWAYS EXPERIMENT STATION
CORPS OF ENGINEERS
VICKSBURG, MS 39180

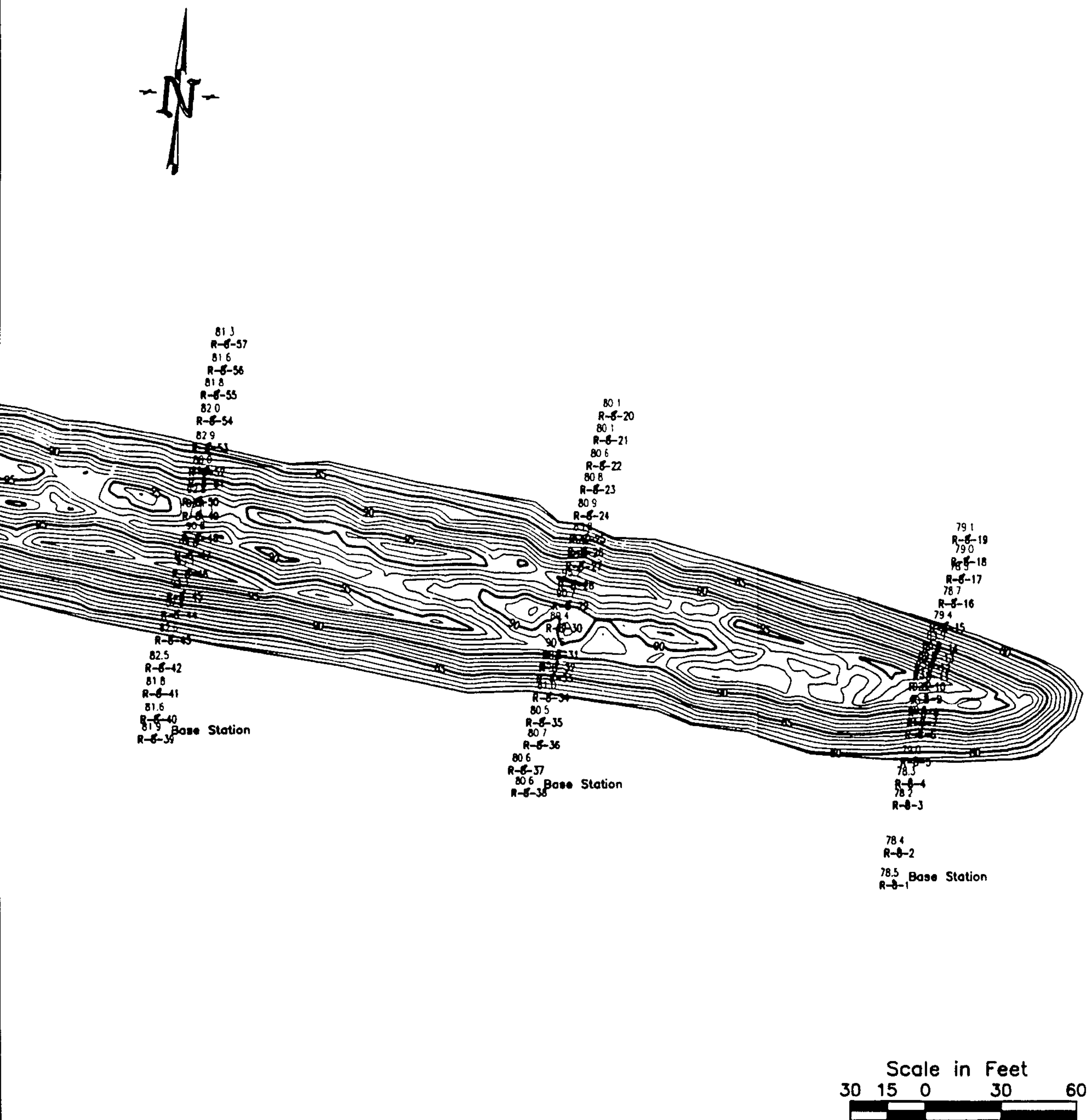
SCALE: 1"=40' | DATE: 8 FEBRUARY 1996 | SHEET 10 of 14

Figure 24. Pile #8, Ravenna Army Ammunition Plant, OH



Elevation Contour Inter
Reference Elevation :
Computed Ore Pile Vol
Reported Gross Weight

Figure 25. Elevation contour map of Pile #8, Ravenna Army Ammunition Plant, OH



ion Contour Interval : 1 FT
ence Elevation : 100 FT
uted Ore Pile Volume : 14,289.2 YDS^3
ted Gross Weight : 71,114,000 LBS

LEGEND

122.0	Station Elevation
•	Station Location
R-8-26	Station Label
———	Major Contour
———	Minor Contour

RAVENNA ARMY AMMUNITION PLANT, OH
PILE #8 CHROMITE ORE
ORE PILE ELEVATION MAP

WATERWAYS EXPERIMENT STATION
CORPS OF ENGINEERS
VICKSBURG, MS 39180

Figure 26. Pile #20, Ravenna Army Ammunition Plant, OH

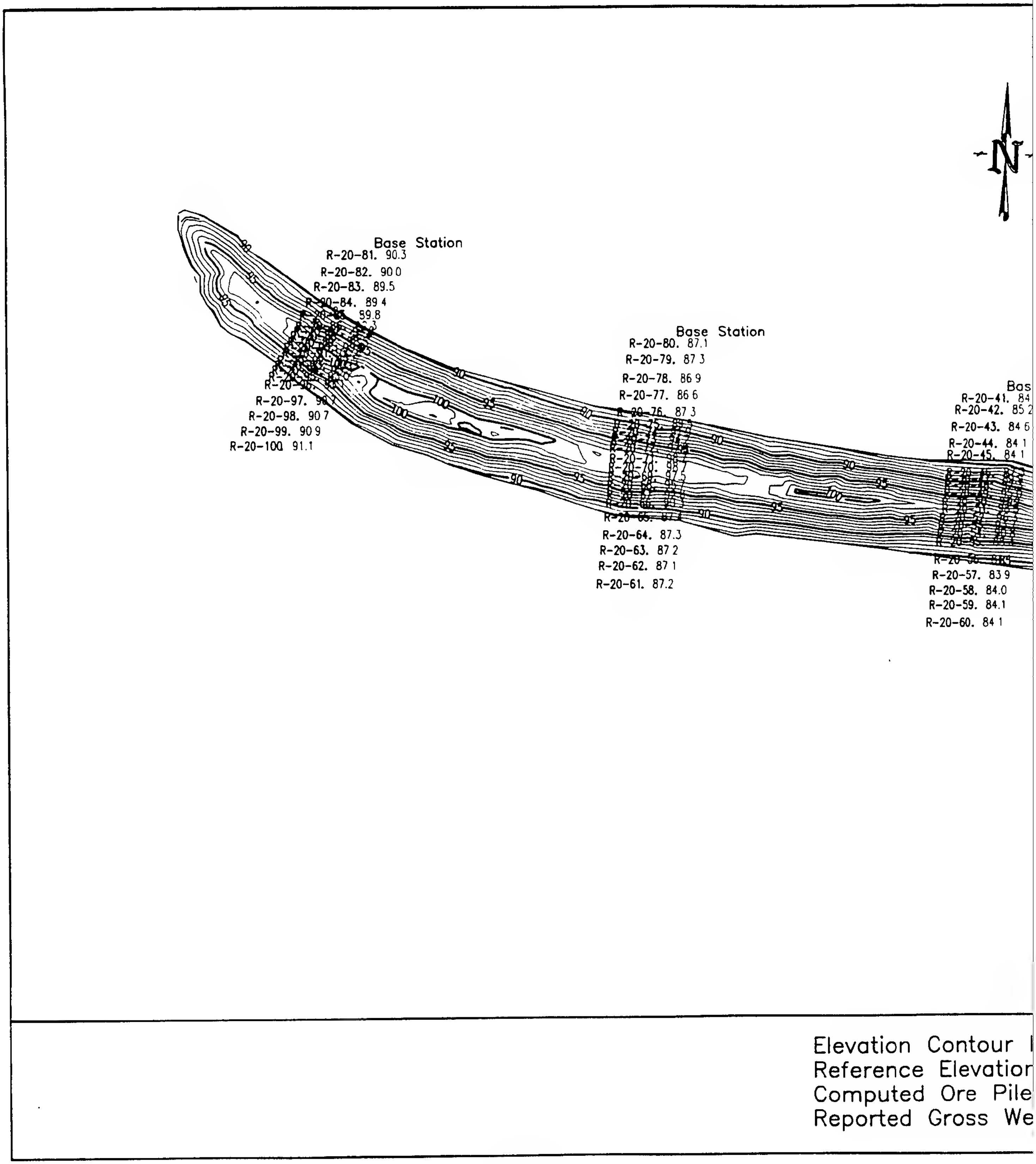
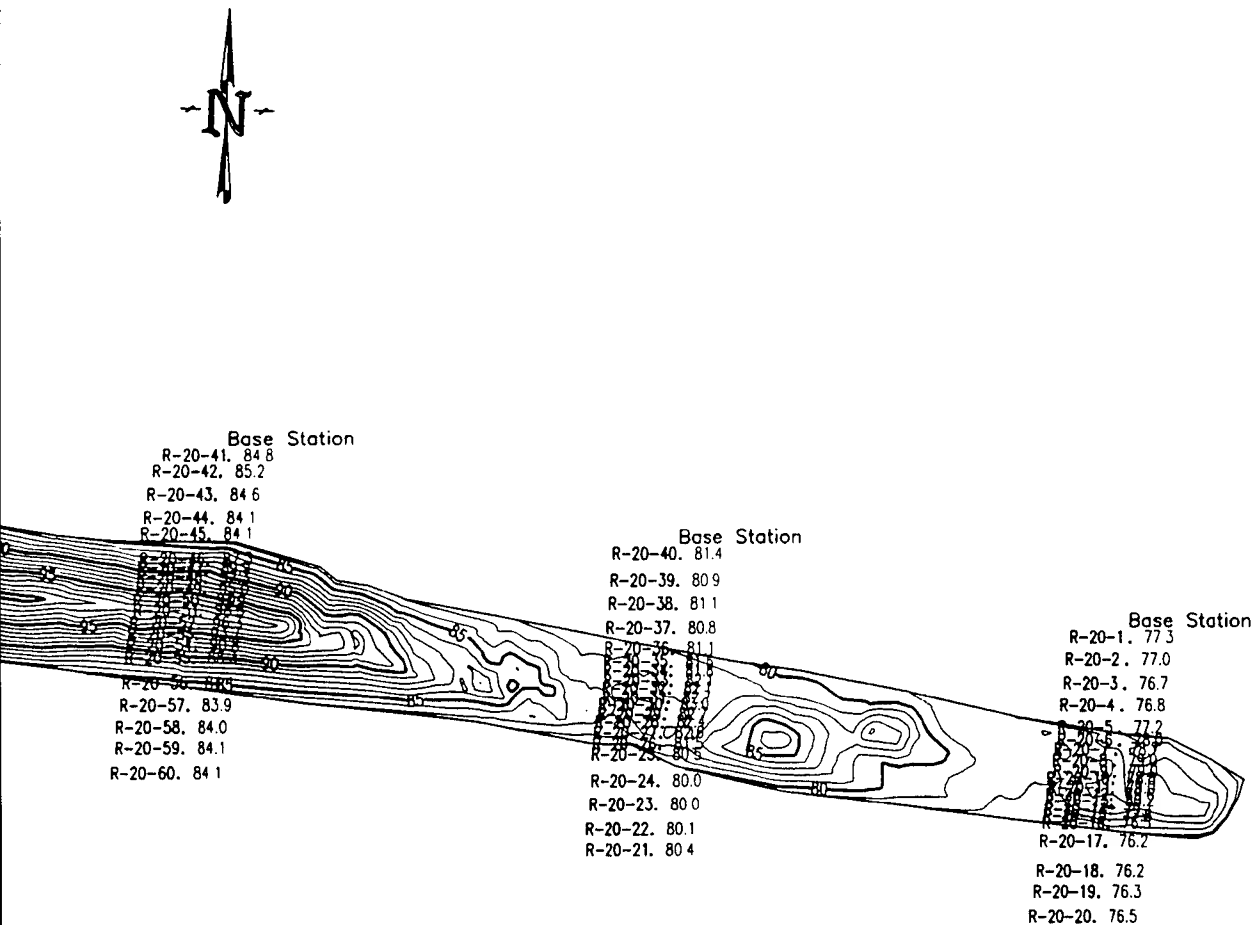


Figure 27. Elevation contour map of Pile #20, Ravenna Army Ammunition Plant, OH



Scale in Feet

37.5 0 37.5 75

ation Contour Interval : 1 FT
erence Elevation : 100 FT
nputed Ore Pile Volume : 8533.3 YDS^3
orted Gross Weight : 27,614,000 LBS

LEGEND

122.0	Station Elevation
•	Station Location
R-20-26	Station Label
———	Major Contour
———	Minor Contour

RAVENNA ARMY AMMUNITION PLANT, OH

PILE #20 MANGANESE ORE
ORE PILE ELEVATION MAP

WATERWAYS EXPERIMENT STATION
CORPS OF ENGINEERS
VICKSBURG, MS 39180

SCALE: 1"=75' | DATE: 8 FEBRUARY 1996 | SHEET 12 of 14

Figure 28. Pile #22, Ravenna Army Ammuntion Plant, OH

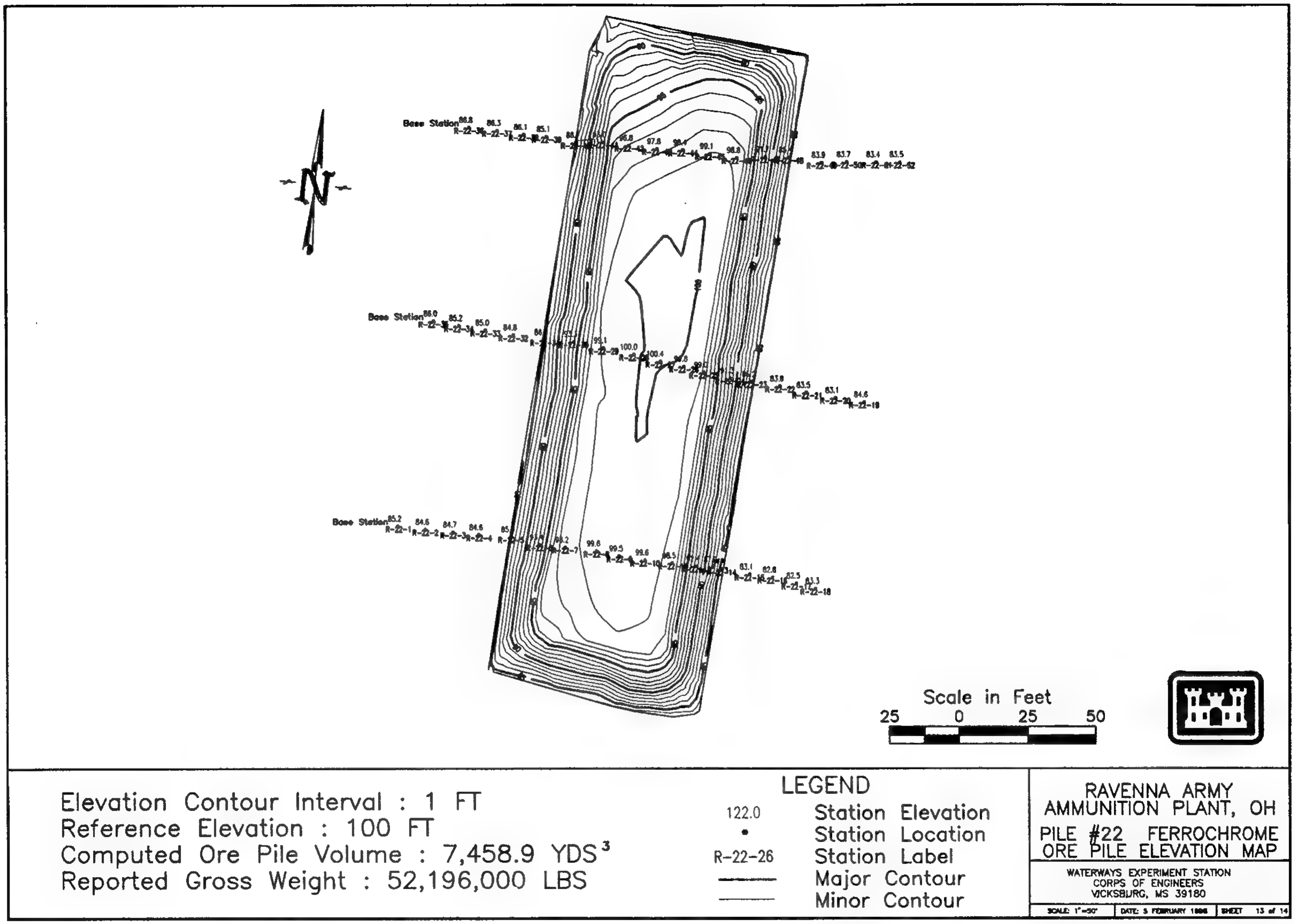


Figure 29. Elevation contour map of Pile #22, Ravenna Army Ammunition Plant, OH

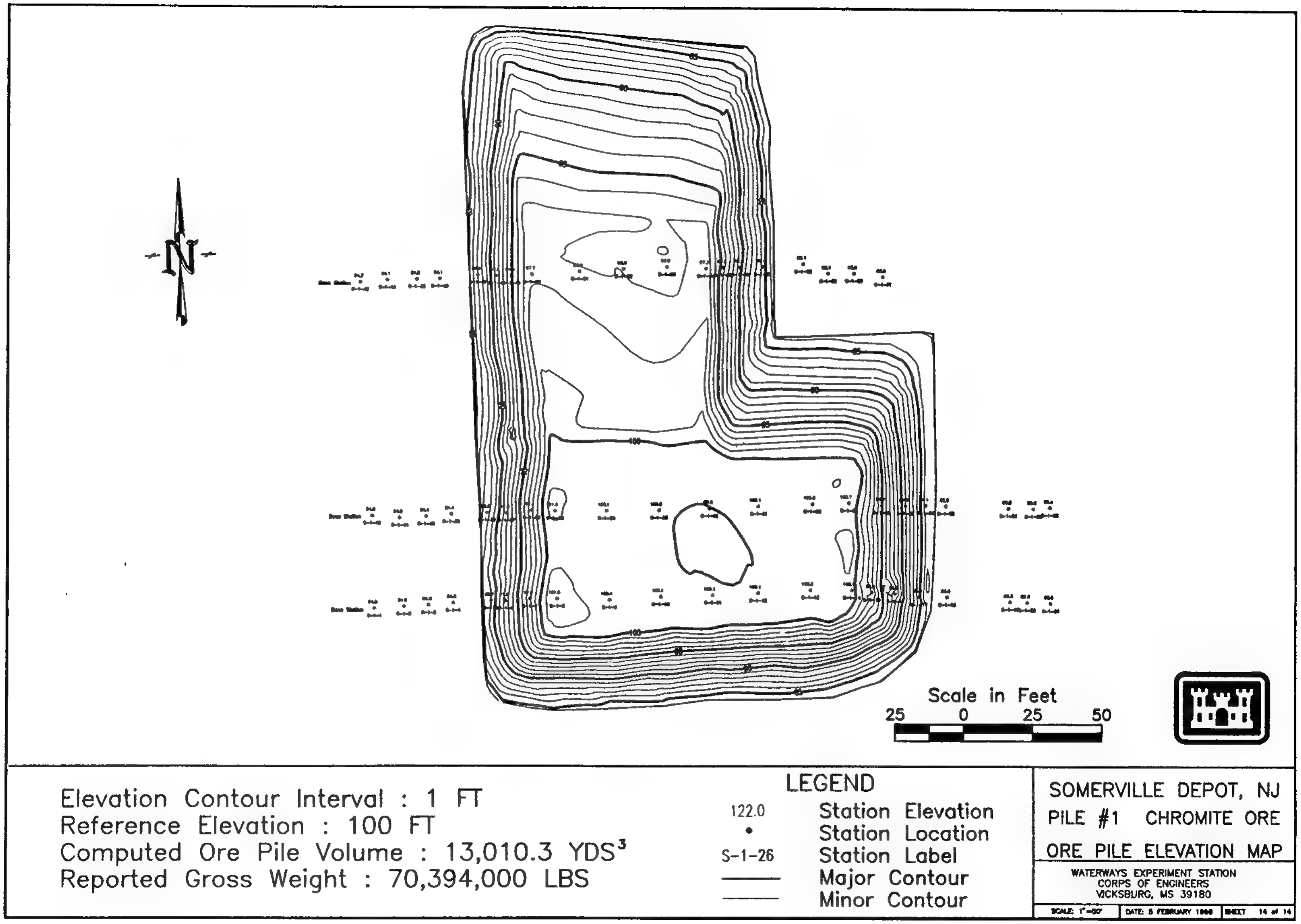


Figure 30. Elevation contour map of Pile #1, Somerville Depot, NJ

Table 1
Reported Descriptions of Ore Stockpiles[1]

Pile Number	Length, ft	Width, ft	Height, ft	Reported Gross Weight, lbs	Material Description
Sierra Army Depot, CA					
No. 1	100	55	30	11,797,640	Chromite Ore, Metallurgical Grade
No. 3	250	100	30	34,529,495	Chromite Ore, Metallurgical Grade
No. 5	100	85	25	31,022,600	Chromite Ore, Metallurgical Grade
No. 6	230	115	25	54,917,860	Chromite Ore, Metallurgical Grade
No. 10	70	60	10	1,846,185	Manganese Ore, Metallurgical Grade
No. 14	400	50	25	34,869,960	Manganese Ore, Metallurgical Grade
No. 15	30	10	10	1,703,220	Tungsten Ore, Low Grade
No. 18A	250	100	30	52,131,980	Chromite Ore, Metallurgical Grade
National Refractory and Minerals Corporation, CA					
No. 1	278	154	10	61,618,036	Chromite Ore, Type B
Hammond Depot, IN					
No. 12	300	250	18	148,812,940	Ferromanganese, High Carbon
Ravenna Army Ammunition Plant, OH					
No. 8	710	60	25	71,114,000	Chromite Ore, Metallurgical Grade, Type II
No. 20	920	70	20	27,614,000	Manganese Ore, Metallurgical Grade, Type II
No. 22	250	80	17	52,196,000	Ferrochrome, Low Carbon
Somerville Depot, NJ					
No. 1	250	160	15	70,394,000	Chromite Ore, Chemical Grade

[1] As provided by DNSC.

Table 2
Computed Volume, Material Density, and Weight of Ore Stockpiles

Pile Number	Average Volume, yd^3	Average Density, g/cm^3	Average Density, lb/ft^3	Average Calculated Weight, lbs
Sierra Army Depot, CA				
No. 1	2,015.9	2.063	128.79	7,009,893.2
No. 3	7,215.7	2.393	149.39	29,104,782.2
No. 5	5,353.6	2.425	151.38	21,882,697.1
No. 6	13,181.9	2.503	156.26	55,613,733.1
No. 10	450.5	2.005	125.16	1,522,482.7
No. 14	8,078.7	1.925	120.17	26,212,920.0
No. 15	306.8	1.990	124.23	1,029,085.9
No. 18A	13,151.9	2.180	136.09	48,326,815.5
National Refractory and Minerals Corporation, CA				
No. 1	12,403.6	2.696	168.31	56,365,170.7
Hammond Depot, IN				
No. 12	19,417.6	3.903	243.66	127,743,051.9
Ravenna Army Ammunition Plant, OH				
No. 8	14,289.2	2.284	142.58	55,010,703.7
No. 20	8,533.3	1.795	112.06	25,818,122.3
No. 22	7,458.9	3.843	239.91	48,315,708.8
Somerville Depot, NJ				
No. 1	13,010.3	2.993	186.84	65,635,260.6

Appendix A
Determination of Ore Pile Volumes, EMC, Inc.

SURVEYING ENGINEERING REPORT

DEFENSE NATIONAL STOCKPILE AUDIT

NOVEMBER 1995

Prepared for:

U. S. ARMY CORPS OF ENGINEERS
VICKSBURG DISTRICT
VICKSBURG, MISSISSIPPI

Prepared by:

EMC, Inc.
101 West Market Street
P. O. Box 8143
Greenwood, MS 38930

SURVEYING ENGINEERING REPORT
DEFENSE NATIONAL STOCKPILE AUDIT
EMC, Inc.

INDEX

APPENDICES

SURVEYING ENGINEERING REPORT
DEFENSE NATIONAL STOCKPILE AUDIT
EMC, Inc.

A. GENERAL. This delivery order consists of performing surveys and installing gravity points on Defense National Stockpiles throughout installations in the U.S. A report containing volumes of the stockpiles is enclosed as appendices A thru N.

B. METHODOLOGY.

1. The topographic surveys were performed by a 3-man survey crew between the dates of November 6, 1995 and December 4, 1995. Topographic field data was collected utilizing a Topcon GTS-3C Total Station with a Hewlett Packard 200 LX Data Collector. This data was then processed in the office to develop the IGDS formatted files. The IGDS design files were transferred to ACAD Version 12 DWG files for submission.

2. The survey limits for the surveys were from toe to toe of each stockpile, including all breaks and significant characteristics in the surface of the stockpiles.

3. Horizontal data was computed using arbitrary coordinates of 100000 North, 100000 East in U. S. Survey Feet. Azimuth orientation is from zero North. Elevations are referenced to an arbitrary elevation 100.

C. DATA SUBMISSION. Mapping of the survey was processed from field data and developed in an IGDS formatted file with a 1-foot contour interval. Volumes were computed using Intergraph InRoads software. A Triangle Volume Report, Grid Volume Report and an End-Area Volume Report was prepared for each stockpile. The Grid Volume Report is based on a grid of 0.5 foot. The End-Area Volume Report is based on 5 foot cross-sections which are shown in the IGDS formatted file. Volumes are in cubic yards. Mapping was provided on a 3-1/2" HD DOS formatted diskette in ACAD Version 12 format.

D. CONTRACTOR INFORMATION. This work was performed by EMC, Inc. of Greenwood, Mississippi (Contract No. DACW66-95-D-0091) under the direction of Mr. Mark Mattox, RLS, President. Inquiries pertaining to this project can be made to Mr. Mattox at (601) 453-0325, Fax Number (606) 453-0338.

SUMMARY OF VOLUME COMPILATIONS

SITE	TRIANGLE	GRID	END-AREA
SIERRA 1	2016.04	2015.60	2016
SIERRA 3	7216.17	7215.52	7215.33
SIERRA 5	5354.04	5353.36	5353.27
SIERRA 6	13185.81	13177.99	13181.68
SIERRA 10	450.60	450.41	450.29
SIERRA 14	8078.58	8077.72	8079.54
SIERRA 15	306.77	306.59	306.82
SIERRA 18A	13153.74	13150.41	13151.55
NATIONAL REFRACTORIES & MINERAL CORP. 1	12404.74	12404.48	12401.42
HAMMOND DEPOT 12	19418.99	19418.02	19415.61
RAVENNA ARMY AMMUNITION PLANT 8	14288.86	14288.18	14290.34
RAVENNA ARMY AMMUNITION PLANT 20	8533.38	8532.46	8533.94
RAVENNA ARMY AMMUNITION PLANT 22	7459.54	7455.93	7460.99
SOMERVILLE DEPOT 1	13011.18	13008.94	13010.75

SIERRA ARMY DEPOT SITE 1

VOLUME REPORTS

Triangle Volume Report

Original Surface: TOE1
Design Surface: SIERRA1

Cut (cu yd)	Fill (cu yd)	Net (cu yd)
0.00	2016.04	-2016.04

Grid Volume Report

Original Surface: TOE1
Design Surface: SIERRA1

Cut (cu yd)	Fill (cu yd)	Net (cu yd)
0.03	2015.63	-2015.60

ALIGNMENT: 1
SURFACE 1: TOE1
SURFACE 2: SIERRA1

BASELINE STATION NUMBER	STAT CUT FACT	STAT CUT AREA	STAT CUT VOL	ADJ STAT CUT VOL	STAT FILL FACT	STAT FILL AREA	STAT FILL VOL	ADJ STAT FILL VOL	********* ADDED QUANTITIES ADJ CUT FACT	CUT VOL	ADJUSTED MASS CUT VOL	FILL FACT	FILL VOL	FILL VOL	ORDINATE VOLUME
0+00	1.00	0.00	0	0	1.00	0.00	0	0	1.00	0	0	1.00	0	0	0
0+05	1.00	0.00	0	0	1.00	47.93	4	4	1.00	0	0	1.00	0	0	-4
0+10	1.00	0.00	0	0	1.00	195.29	23	23	1.00	0	0	1.00	0	0	-27
0+15	1.00	0.00	0	0	1.00	390.58	54	54	1.00	0	0	1.00	0	0	-81
0+20	1.00	0.00	0	0	1.00	583.02	90	90	1.00	0	0	1.00	0	0	-171
0+25	1.00	0.00	0	0	1.00	749.83	123	123	1.00	0	0	1.00	0	0	-295
0+30	1.00	0.00	0	0	1.00	855.00	149	149	1.00	0	0	1.00	0	0	-443
0+35	1.00	0.00	0	0	1.00	864.19	159	159	1.00	0	0	1.00	0	0	-603
0+40	1.00	0.00	0	0	1.00	870.50	161	161	1.00	0	0	1.00	0	0	-763
0+45	1.00	0.00	0	0	1.00	861.12	160	160	1.00	0	0	1.00	0	0	-924
0+50	1.00	0.00	0	0	1.00	835.78	157	157	1.00	0	0	1.00	0	0	-1081
0+55	1.00	0.00	0	0	1.00	796.44	151	151	1.00	0	0	1.00	0	0	-1232
0+60	1.00	0.00	0	0	1.00	753.63	144	144	1.00	0	0	1.00	0	0	-1375
0+65	1.00	0.00	0	0	1.00	691.62	134	134	1.00	0	0	1.00	0	0	-1509
0+70	1.00	0.00	0	0	1.00	603.99	120	120	1.00	0	0	1.00	0	0	-1629
0+75	1.00	0.00	0	0	1.00	510.95	103	103	1.00	0	0	1.00	0	0	-1732
0+80	1.00	0.00	0	0	1.00	414.19	86	86	1.00	0	0	1.00	0	0	-1818
0+85	1.00	0.00	0	0	1.00	340.22	70	70	1.00	0	0	1.00	0	0	-1888
0+90	1.00	0.00	0	0	1.00	244.66	54	54	1.00	0	0	1.00	0	0	-1942
0+95	1.00	0.00	0	0	1.00	148.33	36	36	1.00	0	0	1.00	0	0	-1978
1+00	1.00	0.00	0	0	1.00	77.42	21	21	1.00	0	0	1.00	0	0	-1999
1+05	1.00	0.00	0	0	1.00	39.61	11	11	1.00	0	0	1.00	0	0	-2010
1+10	1.00	0.00	0	0	1.00	11.88	5	5	1.00	0	0	1.00	0	0	-2015
1+15	1.00	0.00	0	0	1.00	0.22	1	1	1.00	0	0	1.00	0	0	-2016
1+20	1.00	0.00	0	0	1.00	0.00	0	0	1.00	0	0	1.00	0	0	-2016

SIERRA ARMY DEPOT SITE 3

VOLUME REPORTS

Triangle Volume Report

Original Surface: toe
Design Surface: sierra3

Cut (cu yd)	Fill (cu yd)	Net (cu yd)
0.00	7216.17	-7216.17

Grid Volume Report

Original Surface: toe
Design Surface: sierra3

Cut (cu yd)	Fill (cu yd)	Net (cu yd)
0.05	7215.57	-7215.52

ALIGNMENT: 3
SURFACE 1: toe
SURFACE 2: sierra3

BASELINE STATION NUMBER	STAT CUT FACT	STAT CUT AREA	STAT CUT VOL	ADJ STAT CUT VOL	STAT FILL FACT	STAT FILL AREA	STAT FILL VOL	ADJ STAT FILL VOL	ADJ CUT FACT	CUT VOL	********* ADDED QUANTITIES CUT VOL	FILL FACT	FILL VOL	ADJUSTED FILL VOL	MASS ORDINATE VOLUME
0	1.00	0.00	0	0	1.00	0.00	0	0	1.00	0	0	1.00	0	0	0
5	1.00	0.00	0	0	1.00	0.47	0	0	1.00	0	0	1.00	0	0	-0
10	1.00	0.00	0	0	1.00	33.22	3	3	1.00	0	0	1.00	0	0	-3
15	1.00	0.00	0	0	1.00	80.49	11	11	1.00	0	0	1.00	0	0	-14
20	1.00	0.00	0	0	1.00	206.69	27	27	1.00	0	0	1.00	0	0	-40
25	1.00	0.00	0	0	1.00	385.63	55	55	1.00	0	0	1.00	0	0	-95
30	1.00	0.00	0	0	1.00	560.49	88	88	1.00	0	0	1.00	0	0	-183
35	1.00	0.00	0	0	1.00	727.48	119	119	1.00	0	0	1.00	0	0	-302
40	1.00	0.00	0	0	1.00	879.42	149	149	1.00	0	0	1.00	0	0	-451
45	1.00	0.00	0	0	1.00	1006.05	175	175	1.00	0	0	1.00	0	0	-625
50	1.00	0.00	0	0	1.00	1065.10	192	192	1.00	0	0	1.00	0	0	-817
55	1.00	0.00	0	0	1.00	1106.14	201	201	1.00	0	0	1.00	0	0	-1018
60	1.00	0.00	0	0	1.00	1117.88	206	206	1.00	0	0	1.00	0	0	-1224
65	1.00	0.00	0	0	1.00	1136.70	209	209	1.00	0	0	1.00	0	0	-1433
70	1.00	0.00	0	0	1.00	1161.05	213	213	1.00	0	0	1.00	0	0	-1646
75	1.00	0.00	0	0	1.00	1200.71	219	219	1.00	0	0	1.00	0	0	-1864
80	1.00	0.00	0	0	1.00	1221.81	221	221	1.00	0	0	1.00	0	0	-3926
125	1.00	0.00	0	0	1.00	1140.41	214	214	1.00	0	0	1.00	0	0	-4140
130	1.00	0.00	0	0	1.00	1109.08	208	208	1.00	0	0	1.00	0	0	-4349
135	1.00	0.00	0	0	1.00	1085.28	203	203	1.00	0	0	1.00	0	0	-4552

ALIGNMENT: 3
SURFACE 1: toe
SURFACE 2: sierra3

					ADJ				ADJ ********* ADDED QUANTITIES						
BASELINE STATION NUMBER	STAT CUT FACT	STAT CUT AREA	STAT CUT VOL	STAT CUT VOL	STAT FILL FACT	STAT FILL AREA	STAT FILL VOL	STAT FILL VOL	ADJ CUT FACT	CUT VOL	CUT VOL	FILL FACT	FILL VOL	ADJUSTED FILL VOL	MASS ORDINATE VOLUME
140	1.00	0.00	0	0	1.00	1072.91	200	200	1.00	0	0	1.00	0	0	-4752
145	1.00	0.00	0	0	1.00	1056.57	197	197	1.00	0	0	1.00	0	0	-4949
150	1.00	0.00	0	0	1.00	1032.33	193	193	1.00	0	0	1.00	0	0	-5142
155	1.00	0.00	0	0	1.00	981.53	186	186	1.00	0	0	1.00	0	0	-5329
160	1.00	0.00	0	0	1.00	926.33	177	177	1.00	0	0	1.00	0	0	-5505
165	1.00	0.00	0	0	1.00	873.57	167	167	1.00	0	0	1.00	0	0	-5672
170	1.00	0.00	0	0	1.00	829.07	158	158	1.00	0	0	1.00	0	0	-5830
175	1.00	0.00	0	0	1.00	788.19	150	150	1.00	0	0	1.00	0	0	-5979
180	1.00	0.00	0	0	1.00	733.16	141	141	1.00	0	0	1.00	0	0	-6120
185	1.00	0.00	0	0	1.00	682.06	131	131	1.00	0	0	1.00	0	0	-6251
190	1.00	0.00	0	0	1.00	648.42	123	123	1.00	0	0	1.00	0	0	-6375
195	1.00	0.00	0	0	1.00	601.94	116	116	1.00	0	0	1.00	0	0	-6490
200	1.00	0.00	0	0	1.00	563.45	108	108	1.00	0	0	1.00	0	0	-6598
205	1.00	0.00	0	0	1.00	512.73	100	100	1.00	0	0	1.00	0	0	-6698
210	1.00	0.00	0	0	1.00	443.82	89	89	1.00	0	0	1.00	0	0	-6786
215	1.00	0.00	0	0	1.00	386.25	77	77	1.00	0	0	1.00	0	0	-6863
220	1.00	0.00	0	0	1.00	321.05	65	65	1.00	0	0	1.00	0	0	-6929
225	1.00	0.00	0	0	1.00	277.27	55	55	1.00	0	0	1.00	0	0	-6984
230	1.00	0.00	0	0	1.00	240.26	48	48	1.00	0	0	1.00	0	0	-7032
235	1.00	0.00	0	0	1.00	241.46	45	45	1.00	0	0	1.00	0	0	-7077
240	1.00	0.00	0	0	1.00	204.34	41	41	1.00	0	0	1.00	0	0	-7118
245	1.00	0.00	0	0	1.00	156.12	33	33	1.00	0	0	1.00	0	0	-7151

ALIGNMENT: 3
SURFACE 1: toe
SURFACE 2: sierra3

					ADJ				ADJ ********* ADDED QUANTITIES						
BASELINE	STAT	STAT	STAT	STAT	STAT	STAT	STAT	STAT	ADJ					ADJUSTED	MASS
STATION	CUT	CUT	CUT	CUT	FILL	FILL	FILL	FILL	CUT	CUT	CUT	FILL	FILL	FILL	ORDINATE
NUMBER	FACT	AREA	VOL	VOL	FACT	AREA	VOL	VOL	FACT	VOL	VOL	FACT	VOL	VOL	VOLUME
250	1.00	0.00	0	0	1.00	117.40	25	25	1.00	0	0	1.00	0	0	-7177
255	1.00	0.00	0	0	1.00	85.85	19	19	1.00	0	0	1.00	0	0	-7196
260	1.00	0.00	0	0	1.00	55.69	13	13	1.00	0	0	1.00	0	0	-7209
265	1.00	0.00	0	0	1.00	9.41	6	6	1.00	0	0	1.00	0	0	-7215
269	1.00	0.00	0	0	1.00	0.00	1	1	1.00	0	0	1.00	0	0	-7215

SIERRA ARMY DEPOT SITE 5

VOLUME REPORTS

Triangle Volume Report

Original Surface: TOE5
Design Surface: SIERRA5

Cut (cu yd)	Fill (cu yd)	Net (cu yd)
0.00	5354.04	-5354.04

Grid Volume Report

Original Surface: TOE5
Design Surface: SIERRA5

Cut (cu yd)	Fill (cu yd)	Net (cu yd)
0.02	5353.38	-5353.36

ALIGNMENT: 5
SURFACE 1: TOE5
SURFACE 2: SIERRA5

BASELINE STATION NUMBER	STAT CUT FACT	STAT CUT AREA	STAT CUT VOL	ADJ STAT CUT VOL	STAT FILL FACT	STAT FILL AREA	STAT FILL VOL	ADJ STAT FILL VOL	********* ADDED QUANTITIES ADJ CUT FACT	CUT VOL	ADJUSTED MASS CUT VOL	FILL FACT	FILL VOL	FILL VOL	ORDINATE VOLUME
0	1.00	0.00	0	0	1.00	0.00	0	0	1.00	0	0	1.00	0	0	0
5	1.00	0.00	0	0	1.00	15.12	1	1	1.00	0	0	1.00	0	0	-1
10	1.00	0.00	0	0	1.00	55.32	7	7	1.00	0	0	1.00	0	0	-8
15	1.00	0.00	0	0	1.00	129.97	17	17	1.00	0	0	1.00	0	0	-25
20	1.00	0.00	0	0	1.00	279.50	38	38	1.00	0	0	1.00	0	0	-63
25	1.00	0.00	0	0	1.00	479.47	70	70	1.00	0	0	1.00	0	0	-133
30	1.00	0.00	0	0	1.00	679.28	107	107	1.00	0	0	1.00	0	0	-241
35	1.00	0.00	0	0	1.00	851.56	142	142	1.00	0	0	1.00	0	0	-382
40	1.00	0.00	0	0	1.00	916.38	164	164	1.00	0	0	1.00	0	0	-546
45	1.00	0.00	0	0	1.00	999.67	177	177	1.00	0	0	1.00	0	0	-723
50	1.00	0.00	0	0	1.00	1078.11	192	192	1.00	0	0	1.00	0	0	-916
55	1.00	0.00	0	0	1.00	1104.34	202	202	1.00	0	0	1.00	0	0	-1118
60	1.00	0.00	0	0	1.00	1120.71	206	206	1.00	0	0	1.00	0	0	-1324
65	1.00	0.00	0	0	1.00	1115.30	207	207	1.00	0	0	1.00	0	0	-1531
70	1.00	0.00	0	0	1.00	1103.83	205	205	1.00	0	0	1.00	0	0	-1736
75	1.00	0.00	0	0	1.00	1102.82	204	204	1.00	0	0	1.00	0	0	-1941
80	1.00	0.00	0	0	1.00	1082.34	202	202	1.00	0	0	1.00	0	0	-2143
85	1.00	0.00	0	0	1.00	1075.81	200	200	1.00	0	0	1.00	0	0	-2343
90	1.00	0.00	0	0	1.00	1087.46	200	200	1.00	0	0	1.00	0	0	-2543
95	1.00	0.00	0	0	1.00	1091.76	202	202	1.00	0	0	1.00	0	0	-2745

ALIGNMENT: 5
SURFACE 1: TOE5
SURFACE 2: SIERRA5

BASELINE STATION NUMBER	STAT CUT FACT	STAT CUT AREA	STAT CUT VOL	STAT CUT VOL	ADJ STAT FILL FACT	STAT FILL AREA	STAT FILL VOL	STAT FILL VOL	ADJ ADJ CUT FACT	CUT VOL	********* ADDED QUANTITIES ADJUSTED MASS CUT VOL	FILL FACT	FILL VOL	FILL VOL	ORDINATE VOLUME
100	1.00	0.00	0	0	1.00	1088.59	202	202	1.00	0	0	1.00	0	0	-2947
105	1.00	0.00	0	0	1.00	1078.44	201	201	1.00	0	0	1.00	0	0	-3148
110	1.00	0.00	0	0	1.00	1048.18	197	197	1.00	0	0	1.00	0	0	-3344
115	1.00	0.00	0	0	1.00	1016.48	191	191	1.00	0	0	1.00	0	0	-3536
120	1.00	0.00	0	0	1.00	936.69	181	181	1.00	0	0	1.00	0	0	-3716
125	1.00	0.00	0	0	1.00	849.22	165	165	1.00	0	0	1.00	0	0	-3882
130	1.00	0.00	0	0	1.00	807.46	153	153	1.00	0	0	1.00	0	0	-4035
135	1.00	0.00	0	0	1.00	781.50	147	147	1.00	0	0	1.00	0	0	-4182
140	1.00	0.00	0	0	1.00	762.77	143	143	1.00	0	0	1.00	0	0	-4325
145	1.00	0.00	0	0	1.00	750.10	140	140	1.00	0	0	1.00	0	0	-4465
150	1.00	0.00	0	0	1.00	769.34	141	141	1.00	0	0	1.00	0	0	-4606
155	1.00	0.00	0	0	1.00	757.31	141	141	1.00	0	0	1.00	0	0	-4747
160	1.00	0.00	0	0	1.00	704.73	135	135	1.00	0	0	1.00	0	0	-4883
165	1.00	0.00	0	0	1.00	646.93	125	125	1.00	0	0	1.00	0	0	-5008
170	1.00	0.00	0	0	1.00	584.14	114	114	1.00	0	0	1.00	0	0	-5122
175	1.00	0.00	0	0	1.00	451.59	96	96	1.00	0	0	1.00	0	0	-5218
180	1.00	0.00	0	0	1.00	260.32	66	66	1.00	0	0	1.00	0	0	-5284
185	1.00	0.00	0	0	1.00	129.93	36	36	1.00	0	0	1.00	0	0	-5320
190	1.00	0.00	0	0	1.00	74.13	19	19	1.00	0	0	1.00	0	0	-5339
195	1.00	0.00	0	0	1.00	41.31	11	11	1.00	0	0	1.00	0	0	-5349
199	1.00	0.00	0	0	1.00	9.42	4	4	1.00	0	0	1.00	0	0	-5353

SIERRA ARMY DEPOT SITE 6

VOLUME REPORTS

Triangle Volume Report

Original Surface: toe6
Design Surface: sierra6

Cut (cu yd)	Fill (cu yd)	Net (cu yd)
0.00	13185.81	-13185.81

Grid Volume Report

Original Surface: toe6
Design Surface: sierra6

Cut (cu yd)	Fill (cu yd)	Net (cu yd)
0.00	13177.99	-13177.99

ALIGNMENT: 6
SURFACE 1: toe6
SURFACE 2: sierra6

BASELINE STATION NUMBER	STAT CUT FACT	STAT CUT AREA	STAT CUT VOL	ADJ STAT CUT VOL	STAT FILL FACT	STAT FILL AREA	STAT FILL VOL	ADJ STAT FILL VOL	********* ADDED QUANTITIES ADJ CUT FACT	CUT VOL	ADJUSTED MASS CUT VOL	FILL FACT	FILL VOL	FILL VOL	ORDINATE VOLUME
0	1.00	0.00	0	0	1.00	0.00	0	0	1.00	0	0	1.00	0	0	0
5	1.00	0.00	0	0	1.00	0.00	0	0	1.00	0	0	1.00	0	0	0
10	1.00	0.00	0	0	1.00	514.83	48	48	1.00	0	0	1.00	0	0	-48
15	1.00	0.00	0	0	1.00	599.13	103	103	1.00	0	0	1.00	0	0	-151
20	1.00	0.00	0	0	1.00	685.70	119	119	1.00	0	0	1.00	0	0	-270
25	1.00	0.00	0	0	1.00	739.68	132	132	1.00	0	0	1.00	0	0	-402
30	1.00	0.00	0	0	1.00	815.06	144	144	1.00	0	0	1.00	0	0	-546
35	1.00	0.00	0	0	1.00	896.15	158	158	1.00	0	0	1.00	0	0	-704
40	1.00	0.00	0	0	1.00	984.10	174	174	1.00	0	0	1.00	0	0	-878
45	1.00	0.00	0	0	1.00	1058.38	189	189	1.00	0	0	1.00	0	0	-1067
50	1.00	0.00	0	0	1.00	1116.41	201	201	1.00	0	0	1.00	0	0	-1269
55	1.00	0.00	0	0	1.00	1143.22	209	209	1.00	0	0	1.00	0	0	-1478
60	1.00	0.00	0	0	1.00	1174.34	215	215	1.00	0	0	1.00	0	0	-1693
65	1.00	0.00	0	0	1.00	1215.57	221	221	1.00	0	0	1.00	0	0	-1914
70	1.00	0.00	0	0	1.00	1275.56	231	231	1.00	0	0	1.00	0	0	-2145
75	1.00	0.00	0	0	1.00	1329.04	241	241	1.00	0	0	1.00	0	0	-2386
80	1.00	0.00	0	0	1.00	1354.31	248	248	1.00	0	0	1.00	0	0	-2634
85	1.00	0.00	0	0	1.00	1368.26	252	252	1.00	0	0	1.00	0	0	-2886
90	1.00	0.00	0	0	1.00	1389.59	255	255	1.00	0	0	1.00	0	0	-3142
95	1.00	0.00	0	0	1.00	1417.19	260	260	1.00	0	0	1.00	0	0	-3401

ALIGNMENT: 6
SURFACE 1: toe6
SURFACE 2: sierra6

									ADJ ********* ADDED QUANTITIES						
					ADJ						ADJUSTED MASS				
BASELINE STATION NUMBER	STAT CUT FACT	STAT CUT AREA	STAT CUT VOL	STAT CUT VOL	STAT FILL FACT	STAT FILL AREA	STAT FILL VOL	STAT FILL VOL	ADJ CUT FACT	CUT VOL	CUT VOL	FILL FACT	FILL VOL	FILL VOL	ORDINATE VOLUME
100	1.00	0.00	0	0	1.00	1436.78	264	264	1.00	0	0	1.00	0	0	-3666
105	1.00	0.00	0	0	1.00	1450.79	267	267	1.00	0	0	1.00	0	0	-3933
110	1.00	0.00	0	0	1.00	1455.59	269	269	1.00	0	0	1.00	0	0	-4202
115	1.00	0.00	0	0	1.00	1457.63	270	270	1.00	0	0	1.00	0	0	-4472
120	1.00	0.00	0	0	1.00	1479.96	272	272	1.00	0	0	1.00	0	0	-4744
125	1.00	0.00	0	0	1.00	1510.24	277	277	1.00	0	0	1.00	0	0	-5021
130	1.00	0.00	0	0	1.00	1546.03	283	283	1.00	0	0	1.00	0	0	-5304
135	1.00	0.00	0	0	1.00	1530.78	285	285	1.00	0	0	1.00	0	0	-5589
140	1.00	0.00	0	0	1.00	1534.17	284	284	1.00	0	0	1.00	0	0	-5872
145	1.00	0.00	0	0	1.00	1549.14	285	285	1.00	0	0	1.00	0	0	-6158
150	1.00	0.00	0	0	1.00	1559.42	288	288	1.00	0	0	1.00	0	0	-6446
155	1.00	0.00	0	0	1.00	1565.89	289	289	1.00	0	0	1.00	0	0	-6735
160	1.00	0.00	0	0	1.00	1567.28	290	290	1.00	0	0	1.00	0	0	-7025
165	1.00	0.00	0	0	1.00	1561.73	290	290	1.00	0	0	1.00	0	0	-7315
170	1.00	0.00	0	0	1.00	1551.02	288	288	1.00	0	0	1.00	0	0	-7603
175	1.00	0.00	0	0	1.00	1539.67	286	286	1.00	0	0	1.00	0	0	-7889
180	1.00	0.00	0	0	1.00	1526.66	284	284	1.00	0	0	1.00	0	0	-8173
185	1.00	0.00	0	0	1.00	1514.16	282	282	1.00	0	0	1.00	0	0	-8455
190	1.00	0.00	0	0	1.00	1498.57	279	279	1.00	0	0	1.00	0	0	-8734
195	1.00	0.00	0	0	1.00	1476.26	275	275	1.00	0	0	1.00	0	0	-9009

ALIGNMENT: 6
SURFACE 1: toe6
SURFACE 2: sierra6

BASELINE STATION NUMBER	STAT CUT FACT	STAT CUT AREA	STAT CUT VOL	STAT CUT VOL	ADJ STAT FILL FACT	STAT FILL AREA	STAT FILL VOL	STAT FILL VOL	ADJ ADJ CUT FACT	CUT VOL	********* ADDED QUANTITIES ADJUSTED MASS CUT VOL	FILL FACT	FILL VOL	FILL VOL	ORDINATE VOLUME
200	1.00	0.00	0	0	1.00	1457.14	272	272	1.00	0	0	1.00	0	0	-9281
205	1.00	0.00	0	0	1.00	1423.54	267	267	1.00	0	0	1.00	0	0	-9548
210	1.00	0.00	0	0	1.00	1388.29	260	260	1.00	0	0	1.00	0	0	-9808
215	1.00	0.00	0	0	1.00	1358.59	254	254	1.00	0	0	1.00	0	0	-10062
220	1.00	0.00	0	0	1.00	1334.07	249	249	1.00	0	0	1.00	0	0	-10312
225	1.00	0.00	0	0	1.00	1319.82	246	246	1.00	0	0	1.00	0	0	-10557
230	1.00	0.00	0	0	1.00	1309.15	243	243	1.00	0	0	1.00	0	0	-10801
235	1.00	0.00	0	0	1.00	1281.23	240	240	1.00	0	0	1.00	0	0	-11041
240	1.00	0.00	0	0	1.00	1239.46	233	233	1.00	0	0	1.00	0	0	-11274
245	1.00	0.00	0	0	1.00	1196.04	226	226	1.00	0	0	1.00	0	0	-11500
250	1.00	0.00	0	0	1.00	1135.24	216	216	1.00	0	0	1.00	0	0	-11715
255	1.00	0.00	0	0	1.00	1062.53	203	203	1.00	0	0	1.00	0	0	-11919
260	1.00	0.00	0	0	1.00	942.44	186	186	1.00	0	0	1.00	0	0	-12105
265	1.00	0.00	0	0	1.00	828.35	164	164	1.00	0	0	1.00	0	0	-12269
270	1.00	0.00	0	0	1.00	736.82	145	145	1.00	0	0	1.00	0	0	-12413
275	1.00	0.00	0	0	1.00	670.34	130	130	1.00	0	0	1.00	0	0	-12544
280	1.00	0.00	0	0	1.00	619.35	119	119	1.00	0	0	1.00	0	0	-12663
285	1.00	0.00	0	0	1.00	586.57	112	112	1.00	0	0	1.00	0	0	-12775
290	1.00	0.00	0	0	1.00	555.45	106	106	1.00	0	0	1.00	0	0	-12881
295	1.00	0.00	0	0	1.00	467.90	95	95	1.00	0	0	1.00	0	0	-12975

ALIGNMENT: 6
SURFACE 1: toe6
SURFACE 2: sierra6

					ADJ				ADJ ********* ADDED QUANTITIES						
											ADJUSTED MASS				
BASELINE STATION NUMBER	STAT CUT FACT	STAT CUT AREA	STAT CUT VOL	STAT CUT VOL	STAT FILL FACT	STAT FILL AREA	STAT FILL VOL	STAT FILL VOL	ADJ CUT FACT	CUT VOL	CUT VOL	FILL FACT	FILL VOL	FILL VOL	ORDINATE VOLUME
300	1.00	0.00	0	0	1.00	358.14	76	76	1.00	0	0	1.00	0	0	-13052
305	1.00	0.00	0	0	1.00	247.70	56	56	1.00	0	0	1.00	0	0	-13108
310	1.00	0.00	0	0	1.00	159.41	38	38	1.00	0	0	1.00	0	0	-13146
315	1.00	0.00	0	0	1.00	74.40	22	22	1.00	0	0	1.00	0	0	-13167
320	1.00	0.00	0	0	1.00	42.24	11	11	1.00	0	0	1.00	0	0	-13178
324	1.00	0.00	0	0	1.00	10.11	4	4	1.00	0	0	1.00	0	0	-13182

SIERRA ARMY DEPOT SITE 10

VOLUME REPORTS

Triangle Volume Report

Original Surface: toe10
Design Surface: sierra10

Cut (cu yd)	Fill (cu yd)	Net (cu yd)
0.00	450.60	-450.60

Grid Volume Report

Original Surface: toe10
Design Surface: sierra10

Cut (cu yd)	Fill (cu yd)	Net (cu yd)
0.00	450.41	-450.41

ALIGNMENT: 10
SURFACE 1: toe10
SURFACE 2: sierra10

BASELINE STATION NUMBER	STAT CUT FACT	STAT CUT AREA	STAT CUT VOL	ADJ STAT CUT VOL	STAT FILL FACT	STAT FILL AREA	STAT FILL VOL	ADJ STAT FILL VOL	********* ADDED QUANTITIES ADJ CUT FACT	CUT VOL	CUT VOL	FILL FACT	FILL VOL	ADJUSTED FILL VOL	MASS ORDINATE VOLUME
0	1.00	0.00	0	0	1.00	0.11	0	0	1.00	0	0	1.00	0	0	0
5	1.00	0.00	0	0	1.00	25.80	2	2	1.00	0	0	1.00	0	0	-2
10	1.00	0.00	0	0	1.00	90.44	11	11	1.00	0	0	1.00	0	0	-13
15	1.00	0.00	0	0	1.00	157.89	23	23	1.00	0	0	1.00	0	0	-36
20	1.00	0.00	0	0	1.00	184.30	32	32	1.00	0	0	1.00	0	0	-68
25	1.00	0.00	0	0	1.00	184.55	34	34	1.00	0	0	1.00	0	0	-102
30	1.00	0.00	0	0	1.00	192.31	35	35	1.00	0	0	1.00	0	0	-137
35	1.00	0.00	0	0	1.00	195.48	36	36	1.00	0	0	1.00	0	0	-173
40	1.00	0.00	0	0	1.00	182.51	35	35	1.00	0	0	1.00	0	0	-208
45	1.00	0.00	0	0	1.00	167.82	32	32	1.00	0	0	1.00	0	0	-240
50	1.00	0.00	0	0	1.00	187.19	33	33	1.00	0	0	1.00	0	0	-273
55	1.00	0.00	0	0	1.00	207.31	37	37	1.00	0	0	1.00	0	0	-310
60	1.00	0.00	0	0	1.00	211.95	39	39	1.00	0	0	1.00	0	0	-348
65	1.00	0.00	0	0	1.00	194.07	38	38	1.00	0	0	1.00	0	0	-386
70	1.00	0.00	0	0	1.00	147.06	32	32	1.00	0	0	1.00	0	0	-418
75	1.00	0.00	0	0	1.00	80.78	21	21	1.00	0	0	1.00	0	0	-439
80	1.00	0.00	0	0	1.00	22.23	10	10	1.00	0	0	1.00	0	0	-448
85	1.00	0.00	0	0	1.00	0.00	2	2	1.00	0	0	1.00	0	0	-450

SIERRA ARMY DEPOT SITE 14

VOLUME REPORTS

Triangle Volume Report

Original Surface: toe14
Design Surface: sierra14

Cut (cu yd)	Fill (cu yd)	Net (cu yd)
0.00	8078.58	-8078.58

Grid Volume Report

Original Surface: toe14
Design Surface: sierra14

Cut (cu yd)	Fill (cu yd)	Net (cu yd)
0.00	8077.73	-8077.72

ALIGNMENT: 14
SURFACE 1: toe14
SURFACE 2: sierra14

BASELINE STATION NUMBER	STAT CUT FACT	STAT CUT AREA	STAT CUT VOL	ADJ STAT CUT VOL	STAT FILL FACT	STAT FILL AREA	STAT FILL VOL	ADJ STAT FILL VOL	ADJ CUT FACT	CUT VOL	CUT VOL	FILL FACT	FILL VOL	ADJUSTED FILL VOL	MASS ORDINATE VOLUME
									********* ADDED QUANTITIES						
0	1.00	0	0	0	1.00	0.00	0	0	1.00	0	0	1.00	0	0	0
5	1.00	0	0	0	1.00	13.97	1	1	1.00	0	0	1.00	0	0	-1
10	1.00	0	0	0	1.00	74.58	8	8	1.00	0	0	1.00	0	0	-9
15	1.00	0	0	0	1.00	115.19	18	18	1.00	0	0	1.00	0	0	-27
20	1.00	0	0	0	1.00	118.57	22	22	1.00	0	0	1.00	0	0	-49
25	1.00	0	0	0	1.00	156.85	26	26	1.00	0	0	1.00	0	0	-74
30	1.00	0	0	0	1.00	226.30	35	35	1.00	0	0	1.00	0	0	-110
35	1.00	0	0	0	1.00	287.44	48	48	1.00	0	0	1.00	0	0	-157
40	1.00	0	0	0	1.00	320.72	56	56	1.00	0	0	1.00	0	0	-214
45	1.00	0	0	0	1.00	325.19	60	60	1.00	0	0	1.00	0	0	-273
50	1.00	0	0	0	1.00	329.56	61	61	1.00	0	0	1.00	0	0	-334
55	1.00	0	0	0	1.00	329.66	61	61	1.00	0	0	1.00	0	0	-395
60	1.00	0	0	0	1.00	324.22	61	61	1.00	0	0	1.00	0	0	-456
65	1.00	0	0	0	1.00	319.98	60	60	1.00	0	0	1.00	0	0	-515
70	1.00	0	0	0	1.00	317.37	59	59	1.00	0	0	1.00	0	0	-574
75	1.00	0	0	0	1.00	318.68	59	59	1.00	0	0	1.00	0	0	-633
80	1.00	0	0	0	1.00	319.96	59	59	1.00	0	0	1.00	0	0	-692
85	1.00	0	0	0	1.00	332.02	60	60	1.00	0	0	1.00	0	0	-753
90	1.00	0	0	0	1.00	338.64	62	62	1.00	0	0	1.00	0	0	-815
95	1.00	0	0	0	1.00	334.32	62	62	1.00	0	0	1.00	0	0	-877

ALIGNMENT: 14
SURFACE 1: toe14
SURFACE 2: sierra14

BASELINE STATION NUMBER	STAT CUT FACT	STAT CUT AREA	STAT CUT VOL	STAT CUT VOL	ADJ STAT FILL FACT	STAT FILL AREA	STAT FILL VOL	STAT FILL VOL	ADJ ********* ADDED QUANTITIES ADJ CUT FACT	CUT VOL	CUT VOL	FILL FACT	FILL VOL	ADJUSTED FILL VOL	MASS ORDINATE VOLUME
100	1.00	0	0	0	1.00	337.47	62	62	1.00	0	0	1.00	0	0	-939
105	1.00	0	0	0	1.00	332.75	62	62	1.00	0	0	1.00	0	0	-1001
110	1.00	0	0	0	1.00	342.65	63	63	1.00	0	0	1.00	0	0	-1064
115	1.00	0	0	0	1.00	348.57	64	64	1.00	0	0	1.00	0	0	-1128
120	1.00	0	0	0	1.00	346.03	64	64	1.00	0	0	1.00	0	0	-1192
125	1.00	0	0	0	1.00	340.73	64	64	1.00	0	0	1.00	0	0	-1256
130	1.00	0	0	0	1.00	338.15	63	63	1.00	0	0	1.00	0	0	-1319
135	1.00	0	0	0	1.00	337.87	63	63	1.00	0	0	1.00	0	0	-1381
140	1.00	0	0	0	1.00	331.20	62	62	1.00	0	0	1.00	0	0	-1443
145	1.00	0	0	0	1.00	323.94	61	61	1.00	0	0	1.00	0	0	-1504
150	1.00	0	0	0	1.00	318.61	59	59	1.00	0	0	1.00	0	0	-1563
155	1.00	0	0	0	1.00	312.23	58	58	1.00	0	0	1.00	0	0	-1622
160	1.00	0	0	0	1.00	300.18	57	57	1.00	0	0	1.00	0	0	-1678
165	1.00	0	0	0	1.00	299.77	56	56	1.00	0	0	1.00	0	0	-1734
170	1.00	0	0	0	1.00	292.82	55	55	1.00	0	0	1.00	0	0	-1789
175	1.00	0	0	0	1.00	272.95	52	52	1.00	0	0	1.00	0	0	-1841
180	1.00	0	0	0	1.00	261.87	50	50	1.00	0	0	1.00	0	0	-1891
185	1.00	0	0	0	1.00	253.80	48	48	1.00	0	0	1.00	0	0	-1939
190	1.00	0	0	0	1.00	257.69	47	47	1.00	0	0	1.00	0	0	-1986
195	1.00	0	0	0	1.00	249.44	47	47	1.00	0	0	1.00	0	0	-2033

ALIGNMENT: 14
SURFACE 1: toe14
SURFACE 2: sierra14

BASELINE STATION NUMBER	STAT CUT FACT	STAT CUT AREA	STAT CUT VOL	STAT CUT VOL	ADJ STAT FILL FACT	STAT FILL AREA	STAT FILL VOL	STAT FILL VOL	ADJ ********* ADDED QUANTITIES ADJ CUT FACT	CUT VOL	CUT VOL	FILL FACT	FILL VOL	ADJUSTED FILL VOL	MASS ORDINATE VOLUME
200	1.00	0	0	0	1.00	255.49	47	47	1.00	0	0	1.00	0	0	-2080
205	1.00	0	0	0	1.00	263.76	48	48	1.00	0	0	1.00	0	0	-2128
210	1.00	0	0	0	1.00	274.74	50	50	1.00	0	0	1.00	0	0	-2178
215	1.00	0	0	0	1.00	288.96	52	52	1.00	0	0	1.00	0	0	-2230
220	1.00	0	0	0	1.00	302.08	55	55	1.00	0	0	1.00	0	0	-2284
225	1.00	0	0	0	1.00	307.72	56	56	1.00	0	0	1.00	0	0	-2341
230	1.00	0	0	0	1.00	306.65	57	57	1.00	0	0	1.00	0	0	-2398
235	1.00	0	0	0	1.00	305.58	57	57	1.00	0	0	1.00	0	0	-2454
240	1.00	0	0	0	1.00	294.29	56	56	1.00	0	0	1.00	0	0	-2510
245	1.00	0	0	0	1.00	282.75	53	53	1.00	0	0	1.00	0	0	-2563
250	1.00	0	0	0	1.00	286.45	53	53	1.00	0	0	1.00	0	0	-2616
255	1.00	0	0	0	1.00	291.63	54	54	1.00	0	0	1.00	0	0	-2670
260	1.00	0	0	0	1.00	296.49	54	54	1.00	0	0	1.00	0	0	-2724
265	1.00	0	0	0	1.00	302.28	55	55	1.00	0	0	1.00	0	0	-2780
270	1.00	0	0	0	1.00	310.78	57	57	1.00	0	0	1.00	0	0	-2836
275	1.00	0	0	0	1.00	311.93	58	58	1.00	0	0	1.00	0	0	-2894
280	1.00	0	0	0	1.00	304.18	57	57	1.00	0	0	1.00	0	0	-2951
285	1.00	0	0	0	1.00	306.86	57	57	1.00	0	0	1.00	0	0	-3008
290	1.00	0	0	0	1.00	307.25	57	57	1.00	0	0	1.00	0	0	-3064
295	1.00	0	0	0	1.00	306.99	57	57	1.00	0	0	1.00	0	0	-3121

ALIGNMENT: 14
SURFACE 1: toe14
SURFACE 2: sierra14

BASELINE STATION NUMBER	STAT CUT FACT	STAT CUT AREA	STAT CUT VOL	STAT CUT VOL	ADJ STAT FILL FACT	STAT FILL AREA	STAT FILL VOL	STAT FILL VOL	ADJ ********* ADDED QUANTITIES ADJ CUT FACT	CUT VOL	CUT VOL	FILL FACT	FILL VOL	ADJUSTED FILL VOL	MASS ORDINATE VOLUME
300	1.00	0	0	0	1.00	327.01	59	59	1.00	0	0	1.00	0	0	-3180
305	1.00	0	0	0	1.00	342.05	62	62	1.00	0	0	1.00	0	0	-3242
310	1.00	0	0	0	1.00	357.41	65	65	1.00	0	0	1.00	0	0	-3307
315	1.00	0	0	0	1.00	363.23	67	67	1.00	0	0	1.00	0	0	-3374
320	1.00	0	0	0	1.00	355.95	67	67	1.00	0	0	1.00	0	0	-3440
325	1.00	0	0	0	1.00	340.67	65	65	1.00	0	0	1.00	0	0	-3505
330	1.00	0	0	0	1.00	331.54	62	62	1.00	0	0	1.00	0	0	-3567
335	1.00	0	0	0	1.00	330.19	61	61	1.00	0	0	1.00	0	0	-3628
340	1.00	0	0	0	1.00	338.50	62	62	1.00	0	0	1.00	0	0	-3690
345	1.00	0	0	0	1.00	357.26	64	64	1.00	0	0	1.00	0	0	-3754
350	1.00	0	0	0	1.00	361.97	67	67	1.00	0	0	1.00	0	0	-3821
355	1.00	0	0	0	1.00	352.23	66	66	1.00	0	0	1.00	0	0	-3887
360	1.00	0	0	0	1.00	339.42	64	64	1.00	0	0	1.00	0	0	-3951
365	1.00	0	0	0	1.00	344.81	63	63	1.00	0	0	1.00	0	0	-4015
370	1.00	0	0	0	1.00	383.53	67	67	1.00	0	0	1.00	0	0	-4082
375	1.00	0	0	0	1.00	454.35	78	78	1.00	0	0	1.00	0	0	-4160
380	1.00	0	0	0	1.00	540.37	92	92	1.00	0	0	1.00	0	0	-4252
385	1.00	0	0	0	1.00	620.04	107	107	1.00	0	0	1.00	0	0	-4359
390	1.00	0	0	0	1.00	660.03	119	119	1.00	0	0	1.00	0	0	-4478
395	1.00	0	0	0	1.00	702.88	126	126	1.00	0	0	1.00	0	0	-4604

ALIGNMENT: 14
SURFACE 1: toe14
SURFACE 2: sierra14

					ADJ				ADJ ********* ADDED QUANTITIES						
BASELINE	STAT	STAT	STAT	STAT	STAT	STAT	STAT	STAT	ADJ					ADJUSTED	MASS
STATION	CUT	CUT	CUT	CUT	FILL	FILL	FILL	FILL	CUT	CUT	CUT	FILL	FILL	FILL	ORDINATE
NUMBER	FACT	AREA	VOL	VOL	FACT	AREA	VOL	VOL	FACT	VOL	VOL	FACT	VOL	VOL	VOLUME
400	1.00	0	0	0	1.00	721.94	132	132	1.00	0	0	1.00	0	0	-4736
405	1.00	0	0	0	1.00	708.78	132	132	1.00	0	0	1.00	0	0	-4868
410	1.00	0	0	0	1.00	735.76	134	134	1.00	0	0	1.00	0	0	-5002
415	1.00	0	0	0	1.00	738.14	136	136	1.00	0	0	1.00	0	0	-5138
420	1.00	0	0	0	1.00	714.33	134	134	1.00	0	0	1.00	0	0	-5273
425	1.00	0	0	0	1.00	685.52	130	130	1.00	0	0	1.00	0	0	-5403
430	1.00	0	0	0	1.00	648.97	124	124	1.00	0	0	1.00	0	0	-5526
435	1.00	0	0	0	1.00	590.56	115	115	1.00	0	0	1.00	0	0	-5641
440	1.00	0	0	0	1.00	532.98	104	104	1.00	0	0	1.00	0	0	-5745
445	1.00	0	0	0	1.00	492.95	95	95	1.00	0	0	1.00	0	0	-5840
450	1.00	0	0	0	1.00	459.46	88	88	1.00	0	0	1.00	0	0	-5928
455	1.00	0	0	0	1.00	513.56	90	90	1.00	0	0	1.00	0	0	-6018
460	1.00	0	0	0	1.00	603.75	103	103	1.00	0	0	1.00	0	0	-6122
465	1.00	0	0	0	1.00	687.65	120	120	1.00	0	0	1.00	0	0	-6241
470	1.00	0	0	0	1.00	778.60	136	136	1.00	0	0	1.00	0	0	-6377
475	1.00	0	0	0	1.00	838.76	150	150	1.00	0	0	1.00	0	0	-6527
480	1.00	0	0	0	1.00	887.65	160	160	1.00	0	0	1.00	0	0	-6687
485	1.00	0	0	0	1.00	898.75	165	165	1.00	0	0	1.00	0	0	-6852
490	1.00	0	0	0	1.00	900.99	167	167	1.00	0	0	1.00	0	0	-7019
495	1.00	0	0	0	1.00	871.75	164	164	1.00	0	0	1.00	0	0	-7183

ALIGNMENT: 14
SURFACE 1: toe14
SURFACE 2: sierra14

BASELINE STATION NUMBER	STAT CUT FACT	STAT CUT AREA	STAT CUT VOL	STAT CUT VOL	ADJ STAT FILL FACT	STAT FILL AREA	STAT FILL VOL	STAT FILL VOL	ADJ ADJ CUT FACT	********* ADDED QUANTITIES CUT VOL	CUT VOL	FILL FACT	FILL VOL	ADJUSTED FILL VOL	MASS ORDINATE VOLUME
500	1.00	0	0	0	1.00	829.45	158	158	1.00	0	0	1.00	0	0	-7340
505	1.00	0	0	0	1.00	770.53	148	148	1.00	0	0	1.00	0	0	-7488
510	1.00	0	0	0	1.00	687.77	135	135	1.00	0	0	1.00	0	0	-7624
515	1.00	0	0	0	1.00	593.90	119	119	1.00	0	0	1.00	0	0	-7742
520	1.00	0	0	0	1.00	480.29	99	99	1.00	0	0	1.00	0	0	-7842
525	1.00	0	0	0	1.00	370.39	79	79	1.00	0	0	1.00	0	0	-7920
530	1.00	0	0	0	1.00	260.34	58	58	1.00	0	0	1.00	0	0	-7979
535	1.00	0	0	0	1.00	176.56	40	40	1.00	0	0	1.00	0	0	-8019
540	1.00	0	0	0	1.00	139.07	29	29	1.00	0	0	1.00	0	0	-8048
545	1.00	0	0	0	1.00	78.99	20	20	1.00	0	0	1.00	0	0	-8069
550	1.00	0	0	0	1.00	18.21	9	9	1.00	0	0	1.00	0	0	-8078
555	1.00	0	0	0	1.00	0.54	2	2	1.00	0	0	1.00	0	0	-8079
557	1.00	0	0	0	1.00	0.00	0	0	1.00	0	0	1.00	0	0	-8079

SIERRA ARMY DEPOT SITE 15

VOLUME REPORTS

Triangle Volume Report

Original Surface: toe15
Design Surface: sierra15

Cut (cu yd)	Fill (cu yd)	Net (cu yd)
0.00	306.77	-306.77

Grid Volume Report

Original Surface: toe15
Design Surface: sierra15

Cut (cu yd)	Fill (cu yd)	Net (cu yd)
0.00	306.59	-306.59

ALIGNMENT: 15
SURFACE 1: toe15
SURFACE 2: sierra15

BASELINE STATION NUMBER	STAT CUT FACT	STAT CUT AREA	STAT CUT VOL	ADJ STAT CUT VOL	STAT FILL FACT	STAT FILL AREA	STAT FILL VOL	ADJ STAT FILL VOL	ADJ CUT FACT	CUT VOL	CUT VOL	FILL FACT	FILL VOL	ADJUSTED FILL VOL	MASS ORDINATE VOLUME
								********* ADDED QUANTITIES							
0	1.00	0.00	0	0	1.00	0.00	0	0	1.00	0	0	1.00	0	0	0
5	1.00	0.00	0	0	1.00	42.41	4	4	1.00	0	0	1.00	0	0	-4
10	1.00	0.00	0	0	1.00	132.01	16	16	1.00	0	0	1.00	0	0	-20
15	1.00	0.00	0	0	1.00	205.11	31	31	1.00	0	0	1.00	0	0	-51
20	1.00	0.00	0	0	1.00	260.36	43	43	1.00	0	0	1.00	0	0	-94
25	1.00	0.00	0	0	1.00	289.38	51	51	1.00	0	0	1.00	0	0	-145
30	1.00	0.00	0	0	1.00	259.89	51	51	1.00	0	0	1.00	0	0	-196
35	1.00	0.00	0	0	1.00	197.18	42	42	1.00	0	0	1.00	0	0	-238
40	1.00	0.00	0	0	1.00	137.59	31	31	1.00	0	0	1.00	0	0	-269
45	1.00	0.00	0	0	1.00	80.39	20	20	1.00	0	0	1.00	0	0	-290
50	1.00	0.00	0	0	1.00	30.63	10	10	1.00	0	0	1.00	0	0	-300
55	1.00	0.00	0	0	1.00	7.49	4	4	1.00	0	0	1.00	0	0	-303
60	1.00	0.00	0	0	1.00	4.12	1	1	1.00	0	0	1.00	0	0	-305
65	1.00	0.00	0	0	1.00	3.94	1	1	1.00	0	0	1.00	0	0	-305
70	1.00	0.00	0	0	1.00	3.22	1	1	1.00	0	0	1.00	0	0	-306
75	1.00	0.00	0	0	1.00	2.29	1	1	1.00	0	0	1.00	0	0	-306
80	1.00	0.00	0	0	1.00	0.94	0	0	1.00	0	0	1.00	0	0	-307
84	1.00	0.00	0	0	1.00	0.00	0	0	1.00	0	0	1.00	0	0	-307

SIERRA ARMY DEPOT SITE 18A

VOLUME REPORTS

Triangle Volume Report

Original Surface: toe18
Design Surface: sierra18

Cut (cu yd)	Fill (cu yd)	Net (cu yd)
0.00	13153.74	-13153.74

Grid Volume Report

Original Surface: toe18
Design Surface: sierra18

Cut (cu yd)	Fill (cu yd)	Net (cu yd)
0.00	13150.41	-13150.41

ALIGNMENT: 18
SURFACE 1: toe18
SURFACE 2: sierra18

				ADJ				ADJ	********* ADDED QUANTITIES					ADJUSTED	MASS
BASELINE STATION NUMBER	STAT CUT FACT	STAT CUT AREA	STAT CUT VOL	STAT CUT VOL	STAT FILL FACT	STAT FILL AREA	STAT FILL VOL	STAT FILL VOL	ADJ CUT FACT	CUT VOL	CUT VOL	FILL FACT	FILL VOL	FILL VOL	ORDINATE VOLUME
0	1.00	0.00	0	0	1.00	2.18	0	0	1.00	0	0	1.00	0	0	0
5	1.00	0.25	0	0	1.00	27.01	3	3	1.00	0	0	1.00	0	0	-3
10	1.00	0.02	0	0	1.00	97.09	11	11	1.00	0	0	1.00	0	0	-14
15	1.00	7.71	1	1	1.00	154.47	23	23	1.00	0	0	1.00	0	0	-37
20	1.00	0.00	1	1	1.00	299.37	42	42	1.00	0	0	1.00	0	0	-78
25	1.00	0.00	0	0	1.00	452.25	70	70	1.00	0	0	1.00	0	0	-148
30	1.00	0.00	0	0	1.00	606.24	98	98	1.00	0	0	1.00	0	0	-246
35	1.00	0.00	0	0	1.00	729.46	124	124	1.00	0	0	1.00	0	0	-369
40	1.00	0.00	0	0	1.00	772.38	139	139	1.00	0	0	1.00	0	0	-508
45	1.00	0.00	0	0	1.00	815.75	147	147	1.00	0	0	1.00	0	0	-655
50	1.00	0.00	0	0	1.00	855.37	155	155	1.00	0	0	1.00	0	0	-810
55	1.00	0.00	0	0	1.00	900.07	163	163	1.00	0	0	1.00	0	0	-973
60	1.00	0.00	0	0	1.00	959.86	172	172	1.00	0	0	1.00	0	0	-1145
65	1.00	0.00	0	0	1.00	1045.32	186	186	1.00	0	0	1.00	0	0	-1331
70	1.00	0.00	0	0	1.00	1146.13	203	203	1.00	0	0	1.00	0	0	-1533
75	1.00	0.00	0	0	1.00	1237.77	221	221	1.00	0	0	1.00	0	0	-1754
80	1.00	0.00	0	0	1.00	1316.11	236	236	1.00	0	0	1.00	0	0	-1991
85	1.00	0.00	0	0	1.00	1360.53	248	248	1.00	0	0	1.00	0	0	-2239
90	1.00	0.00	0	0	1.00	1391.87	255	255	1.00	0	0	1.00	0	0	-2493
95	1.00	0.00	0	0	1.00	1417.32	260	260	1.00	0	0	1.00	0	0	-2753

ALIGNMENT: 18
SURFACE 1: toe18
SURFACE 2: sierra18

BASELINE STATION NUMBER	STAT CUT FACT	STAT CUT AREA	STAT CUT VOL	STAT CUT VOL	ADJ STAT FILL FACT	STAT FILL AREA	STAT FILL VOL	STAT FILL VOL	ADJ ADJ CUT FACT	CUT VOL	CUT VOL	FILL FACT	FILL VOL	ADJUSTED FILL VOL	MASS ORDINATE VOLUME
									********* ADDED QUANTITIES						
100	1.00	0.00	0	0	1.00	1444.40	265	265	1.00	0	0	1.00	0	0	-3018
105	1.00	0.00	0	0	1.00	1463.31	269	269	1.00	0	0	1.00	0	0	-3288
110	1.00	0.00	0	0	1.00	1486.78	273	273	1.00	0	0	1.00	0	0	-3561
115	1.00	0.00	0	0	1.00	1513.71	278	278	1.00	0	0	1.00	0	0	-3839
120	1.00	0.00	0	0	1.00	1543.92	283	283	1.00	0	0	1.00	0	0	-4122
125	1.00	0.00	0	0	1.00	1569.14	288	288	1.00	0	0	1.00	0	0	-4410
130	1.00	0.00	0	0	1.00	1587.99	292	292	1.00	0	0	1.00	0	0	-4702
135	1.00	0.00	0	0	1.00	1601.31	295	295	1.00	0	0	1.00	0	0	-4998
140	1.00	0.00	0	0	1.00	1650.80	301	301	1.00	0	0	1.00	0	0	-5299
145	1.00	0.00	0	0	1.00	1690.59	309	309	1.00	0	0	1.00	0	0	-5608
150	1.00	0.00	0	0	1.00	1709.00	315	315	1.00	0	0	1.00	0	0	-5923
155	1.00	0.00	0	0	1.00	1717.39	317	317	1.00	0	0	1.00	0	0	-6240
160	1.00	0.00	0	0	1.00	1713.73	318	318	1.00	0	0	1.00	0	0	-6558
165	1.00	0.00	0	0	1.00	1731.84	319	319	1.00	0	0	1.00	0	0	-6877
170	1.00	0.00	0	0	1.00	1757.30	323	323	1.00	0	0	1.00	0	0	-7200
175	1.00	0.00	0	0	1.00	1775.97	327	327	1.00	0	0	1.00	0	0	-7527
180	1.00	0.00	0	0	1.00	1782.27	329	329	1.00	0	0	1.00	0	0	-7857
185	1.00	0.00	0	0	1.00	1762.32	328	328	1.00	0	0	1.00	0	0	-8185
190	1.00	0.00	0	0	1.00	1732.16	324	324	1.00	0	0	1.00	0	0	-8508
195	1.00	0.00	0	0	1.00	1691.80	317	317	1.00	0	0	1.00	0	0	-8825

ALIGNMENT: 18
SURFACE 1: toe18
SURFACE 2: sierra18

BASELINE STATION NUMBER	STAT CUT FACT	STAT CUT AREA	STAT CUT VOL	STAT CUT VOL	ADJ STAT FILL FACT	STAT FILL AREA	STAT FILL VOL	STAT FILL VOL	ADJ ********* ADDED QUANTITIES ADJ CUT FACT	CUT VOL	CUT VOL	FILL FACT	FILL VOL	ADJUSTED FILL VOL	MASS ORDINATE VOLUME
200	1.00	0.00	0	0	1.00	1670.79	311	311	1.00	0	0	1.00	0	0	-9137
205	1.00	0.00	0	0	1.00	1661.28	309	309	1.00	0	0	1.00	0	0	-9445
210	1.00	0.00	0	0	1.00	1646.87	306	306	1.00	0	0	1.00	0	0	-9752
215	1.00	0.00	0	0	1.00	1637.74	304	304	1.00	0	0	1.00	0	0	-10056
220	1.00	0.00	0	0	1.00	1619.66	302	302	1.00	0	0	1.00	0	0	-10357
225	1.00	0.00	0	0	1.00	1588.36	297	297	1.00	0	0	1.00	0	0	-10654
230	1.00	0.00	0	0	1.00	1559.20	291	291	1.00	0	0	1.00	0	0	-10946
235	1.00	0.00	0	0	1.00	1525.09	286	286	1.00	0	0	1.00	0	0	-11231
240	1.00	0.00	0	0	1.00	1487.06	279	279	1.00	0	0	1.00	0	0	-11510
245	1.00	0.00	0	0	1.00	1432.53	270	270	1.00	0	0	1.00	0	0	-11781
250	1.00	0.00	0	0	1.00	1340.18	257	257	1.00	0	0	1.00	0	0	-12037
255	1.00	0.00	0	0	1.00	1201.35	235	235	1.00	0	0	1.00	0	0	-12273
260	1.00	0.00	0	0	1.00	1014.94	205	205	1.00	0	0	1.00	0	0	-12478
265	1.00	0.00	0	0	1.00	811.70	169	169	1.00	0	0	1.00	0	0	-12647
270	1.00	0.00	0	0	1.00	636.48	134	134	1.00	0	0	1.00	0	0	-12781
275	1.00	0.00	0	0	1.00	474.55	103	103	1.00	0	0	1.00	0	0	-12884
280	1.00	0.00	0	0	1.00	350.60	76	76	1.00	0	0	1.00	0	0	-12960
285	1.00	0.00	0	0	1.00	275.24	58	58	1.00	0	0	1.00	0	0	-13018
290	1.00	0.00	0	0	1.00	209.46	45	45	1.00	0	0	1.00	0	0	-13063
295	1.00	0.00	0	0	1.00	155.46	34	34	1.00	0	0	1.00	0	0	-13097

ALIGNMENT: 18
SURFACE 1: toe18
SURFACE 2: sierra18

BASELINE STATION NUMBER	STAT CUT FACT	STAT CUT AREA	STAT CUT VOL	STAT CUT VOL	ADJ STAT FILL FACT	STAT FILL AREA	STAT FILL VOL	STAT FILL VOL	ADJ ********* ADDED QUANTITIES ADJ CUT FACT	CUT VOL	CUT VOL	FILL FACT	FILL VOL	.00 FILL VOL	ADJUSTED MASS ORDINATE VOLUME
300	1.00	0.00	0	0	1.00	113.51	25	25	1.00	0	0	1.00	0	0	-13122
305	1.00	0.00	0	0	1.00	74.94	17	17	1.00	0	0	1.00	0	0	-13139
310	1.00	0.00	0	0	1.00	19.99	9	9	1.00	0	0	1.00	0	0	-13148
315	1.00	0.00	0	0	1.00	0.17	2	2	1.00	0	0	1.00	0	0	-13150
319	1.00	0.00	0	0	1.00	0.00	0	0	1.00	0	0	1.00	0	0	-13150

NATIONAL REFRACTORIES & MINERALS CORP.

PILE 1

VOLUME REPORTS

Triangle Volume Report

Original Surface: nattoe1
Design Surface: natref1

Cut (cu yd)	Fill (cu yd)	Net (cu yd)
0.27	12404.96	-12404.69

Grid Volume Report

Original Surface: nattoe1
Design Surface: natref1

Cut (cu yd)	Fill (cu yd)	Net (cu yd)
0.27	12404.79	-12404.52

ALIGNMENT: natref1
SURFACE 1: nattoe1
SURFACE 2: natref1

BASELINE STATION NUMBER	STAT CUT FACT	STAT CUT AREA	STAT CUT VOL	ADJ STAT CUT VOL	STAT FILL FACT	STAT FILL AREA	STAT FILL VOL	ADJ STAT FILL VOL	ADJ CUT FACT	********* ADDED QUANTITIES CUT VOL	CUT VOL	FILL FACT	FILL VOL	ADJUSTED FILL VOL	MASS ORDINATE VOLUME
0+00	1.00	0.00	0	0	1.00	0.00	0	0	1.00	0	0	1.00	0	0	0
0+05	1.00	0.00	0	0	1.00	4.13	0	0	1.00	0	0	1.00	0	0	-0
0+10	1.00	0.00	0	0	1.00	43.54	4	4	1.00	0	0	1.00	0	0	-5
0+15	1.00	0.00	0	0	1.00	63.59	10	10	1.00	0	0	1.00	0	0	-15
0+20	1.00	0.00	0	0	1.00	377.09	41	41	1.00	0	0	1.00	0	0	-56
0+25	1.00	0.00	0	0	1.00	738.58	103	103	1.00	0	0	1.00	0	0	-159
0+30	1.00	0.08	0	0	1.00	998.65	161	161	1.00	0	0	1.00	0	0	-320
0+35	1.00	1.07	0	0	1.00	1069.28	191	191	1.00	0	0	1.00	0	0	-511
0+40	1.00	0.38	0	0	1.00	1094.41	200	200	1.00	0	0	1.00	0	0	-711
0+45	1.00	0.06	0	0	1.00	1104.19	204	204	1.00	0	0	1.00	0	0	-915
0+50	1.00	0.00	0	0	1.00	1116.26	206	206	1.00	0	0	1.00	0	0	-1120
0+55	1.00	0.00	0	0	1.00	1130.27	208	208	1.00	0	0	1.00	0	0	-1328
0+60	1.00	0.00	0	0	1.00	1143.83	211	211	1.00	0	0	1.00	0	0	-1539
0+65	1.00	0.00	0	0	1.00	1159.19	213	213	1.00	0	0	1.00	0	0	-1752
0+70	1.00	0.00	0	0	1.00	1174.11	216	216	1.00	0	0	1.00	0	0	-1968
0+75	1.00	0.00	0	0	1.00	1188.55	219	219	1.00	0	0	1.00	0	0	-2187
0+80	1.00	0.00	0	0	1.00	1193.16	221	221	1.00	0	0	1.00	0	0	-2408
0+85	1.00	0.00	0	0	1.00	1197.68	221	221	1.00	0	0	1.00	0	0	-2629
0+90	1.00	0.00	0	0	1.00	1197.77	222	222	1.00	0	0	1.00	0	0	-2851
0+95	1.00	0.00	0	0	1.00	1195.49	222	222	1.00	0	0	1.00	0	0	-3072

ALIGNMENT: natrefl
SURFACE 1: nattoel
SURFACE 2: natrefl

BASELINE STATION NUMBER	STAT CUT FACT	STAT CUT AREA	STAT CUT VOL	STAT CUT VOL	ADJ STAT FILL FACT	STAT FILL AREA	STAT FILL VOL	ADJ STAT FILL VOL	ADJ CUT FACT	CUT VOL	CUT VOL	FILL FACT	FILL VOL	ADJUSTED FILL VOL	MASS ORDINATE VOLUME
								********* ADDED QUANTITIES							
1+00	1.00	0.00	0	0	1.00	1194.18	221	221	1.00	0	0	1.00	0	0	-3294
1+05	1.00	0.00	0	0	1.00	1192.45	221	221	1.00	0	0	1.00	0	0	-3515
1+10	1.00	0.00	0	0	1.00	1189.87	221	221	1.00	0	0	1.00	0	0	-3735
1+15	1.00	0.00	0	0	1.00	1185.65	220	220	1.00	0	0	1.00	0	0	-3955
1+20	1.00	0.00	0	0	1.00	1192.49	220	220	1.00	0	0	1.00	0	0	-4175
1+25	1.00	0.00	0	0	1.00	1190.94	221	221	1.00	0	0	1.00	0	0	-4396
1+30	1.00	0.00	0	0	1.00	1184.79	220	220	1.00	0	0	1.00	0	0	-4616
1+35	1.00	0.00	0	0	1.00	1178.34	219	219	1.00	0	0	1.00	0	0	-4835
1+40	1.00	0.00	0	0	1.00	1169.43	217	217	1.00	0	0	1.00	0	0	-5052
1+45	1.00	0.00	0	0	1.00	1145.19	214	214	1.00	0	0	1.00	0	0	-5266
1+50	1.00	0.00	0	0	1.00	1113.98	209	209	1.00	0	0	1.00	0	0	-5476
1+55	1.00	0.00	0	0	1.00	1096.27	205	205	1.00	0	0	1.00	0	0	-5680
1+60	1.00	0.00	0	0	1.00	1087.05	202	202	1.00	0	0	1.00	0	0	-5882
1+65	1.00	0.00	0	0	1.00	1144.02	207	207	1.00	0	0	1.00	0	0	-6089
1+70	1.00	0.00	0	0	1.00	1109.68	209	209	1.00	0	0	1.00	0	0	-6298
1+75	1.00	0.00	0	0	1.00	1096.24	204	204	1.00	0	0	1.00	0	0	-6502
1+80	1.00	0.00	0	0	1.00	1091.07	203	203	1.00	0	0	1.00	0	0	-6704
1+85	1.00	0.00	0	0	1.00	1089.48	202	202	1.00	0	0	1.00	0	0	-6906
1+90	1.00	0.00	0	0	1.00	1098.50	203	203	1.00	0	0	1.00	0	0	-7109
1+95	1.00	0.00	0	0	1.00	1126.93	206	206	1.00	0	0	1.00	0	0	-7315

ALIGNMENT: natrefl
SURFACE 1: nattoe1
SURFACE 2: natrefl

BASELINE STATION NUMBER	STAT CUT FACT	STAT CUT AREA	STAT CUT VOL	STAT CUT VOL	ADJ STAT FILL FACT	STAT FILL AREA	STAT FILL VOL	STAT FILL VOL	ADJ ********* ADDED QUANTITIES ADJ CUT FACT	CUT VOL	CUT VOL	FILL FACT	FILL VOL	FILL VOL	ADJUSTED MASS ORDINATE VOLUME
2+00	1.00	0.00	0	0	1.00	1198.47	215	215	1.00	0	0	1.00	0	0	-7530
2+05	1.00	0.00	0	0	1.00	1275.55	229	229	1.00	0	0	1.00	0	0	-7759
2+10	1.00	0.00	0	0	1.00	1331.22	241	241	1.00	0	0	1.00	0	0	-8001
2+15	1.00	0.00	0	0	1.00	1376.06	251	251	1.00	0	0	1.00	0	0	-8251
2+20	1.00	0.00	0	0	1.00	1416.69	259	259	1.00	0	0	1.00	0	0	-8510
2+25	1.00	0.00	0	0	1.00	1477.70	268	268	1.00	0	0	1.00	0	0	-8778
2+30	1.00	0.00	0	0	1.00	1620.35	287	287	1.00	0	0	1.00	0	0	-9065
2+35	1.00	0.00	0	0	1.00	1767.62	314	314	1.00	0	0	1.00	0	0	-9379
2+40	1.00	0.00	0	0	1.00	1784.45	329	329	1.00	0	0	1.00	0	0	-9708
2+45	1.00	0.00	0	0	1.00	1770.02	329	329	1.00	0	0	1.00	0	0	-10037
2+50	1.00	0.00	0	0	1.00	1756.19	327	327	1.00	0	0	1.00	0	0	-10363
2+55	1.00	0.00	0	0	1.00	1749.49	325	325	1.00	0	0	1.00	0	0	-10688
2+60	1.00	0.00	0	0	1.00	1737.67	323	323	1.00	0	0	1.00	0	0	-11011
2+65	1.00	0.00	0	0	1.00	1725.64	321	321	1.00	0	0	1.00	0	0	-11331
2+70	1.00	0.00	0	0	1.00	1684.76	316	316	1.00	0	0	1.00	0	0	-11647
2+75	1.00	0.00	0	0	1.00	1445.77	290	290	1.00	0	0	1.00	0	0	-11937
2+80	1.00	0.00	0	0	1.00	1055.87	232	232	1.00	0	0	1.00	0	0	-12169
2+85	1.00	0.00	0	0	1.00	603.37	154	154	1.00	0	0	1.00	0	0	-12322
2+90	1.00	0.00	0	0	1.00	130.14	68	68	1.00	0	0	1.00	0	0	-12390
2+95	1.00	0.00	0	0	1.00	0.00	11	11	1.00	0	0	1.00	0	0	-12401

HAMMOND DEPOT PILE 12

VOLUME REPORTS

Triangle Volume Report

Original Surface: toe12
Design Surface: hamnd12

Cut (cu yd)	Fill (cu yd)	Net (cu yd)
0.00	19418.79	-19418.79

Grid Volume Report

Original Surface: toe12
Design Surface: hamnd12

Cut (cu yd)	Fill (cu yd)	Net (cu yd)
0.03	19418.02	-19417.99

ALIGNMENT: 12
SURFACE 1: toe12
SURFACE 2: hamnd12

BASELINE STATION NUMBER	STAT CUT FACT	STAT CUT AREA	STAT CUT VOL	ADJ STAT CUT VOL	STAT FILL FACT	STAT FILL AREA	STAT FILL VOL	ADJ STAT FILL VOL	ADJ CUT FACT	CUT VOL	CUT VOL	FILL FACT	FILL VOL	ADJUSTED FILL VOL	MASS ORDINATE VOLUME
									********* ADDED QUANTITIES						
0+00	1.00	0.00	0	0	1.00	5.27	0	0	1.00	0	0	1.00	0	0	0
0+05	1.00	0.00	0	0	1.00	278.42	26	26	1.00	0	0	1.00	0	0	-26
0+10	1.00	0.00	0	0	1.00	821.03	102	102	1.00	0	0	1.00	0	0	-128
0+15	1.00	0.00	0	0	1.00	1317.50	198	198	1.00	0	0	1.00	0	0	-326
0+20	1.00	0.00	0	0	1.00	1610.15	271	271	1.00	0	0	1.00	0	0	-597
0+25	1.00	0.00	0	0	1.00	1945.16	329	329	1.00	0	0	1.00	0	0	-926
0+30	1.00	0.00	0	0	1.00	2382.85	401	401	1.00	0	0	1.00	0	0	-1327
0+35	1.00	0.00	0	0	1.00	2801.64	480	480	1.00	0	0	1.00	0	0	-1807
0+40	1.00	0.00	0	0	1.00	2938.95	532	532	1.00	0	0	1.00	0	0	-2339
0+45	1.00	0.00	0	0	1.00	3027.13	552	552	1.00	0	0	1.00	0	0	-2891
0+50	1.00	0.00	0	0	1.00	3130.72	570	570	1.00	0	0	1.00	0	0	-3461
0+55	1.00	0.00	0	0	1.00	3258.86	592	592	1.00	0	0	1.00	0	0	-4053
0+60	1.00	0.00	0	0	1.00	3373.93	614	614	1.00	0	0	1.00	0	0	-4667
0+65	1.00	0.00	0	0	1.00	3489.46	635	635	1.00	0	0	1.00	0	0	-5303
0+70	1.00	0.00	0	0	1.00	3608.58	657	657	1.00	0	0	1.00	0	0	-5960
0+75	1.00	0.00	0	0	1.00	3716.53	678	678	1.00	0	0	1.00	0	0	-6638
0+80	1.00	0.00	0	0	1.00	3813.74	697	697	1.00	0	0	1.00	0	0	-7335
0+85	1.00	0.00	0	0	1.00	3897.29	714	714	1.00	0	0	1.00	0	0	-8049
0+90	1.00	0.00	0	0	1.00	3922.31	724	724	1.00	0	0	1.00	0	0	-8773
0+95	1.00	0.00	0	0	1.00	3942.10	728	728	1.00	0	0	1.00	0	0	-9501

ALIGNMENT: 12
SURFACE 1: toe12
SURFACE 2: hamnd12

BASELINE STATION NUMBER	STAT CUT FACT	STAT CUT AREA	STAT CUT VOL	STAT CUT VOL	ADJ STAT FILL FACT	STAT FILL AREA	STAT FILL VOL	STAT FILL VOL	ADJ ADJ CUT FACT	********* ADDED QUANTITIES CUT VOL	CUT VOL	FILL FACT	FILL VOL	ADJUSTED FILL VOL	MASS ORDINATE VOLUME
1+00	1.00	0.00	0	0	1.00	3961.60	732	732	1.00	0	0	1.00	0	0	-10233
1+05	1.00	0.00	0	0	1.00	3980.59	735	735	1.00	0	0	1.00	0	0	-10969
1+10	1.00	0.00	0	0	1.00	3998.27	739	739	1.00	0	0	1.00	0	0	-11707
1+15	1.00	0.00	0	0	1.00	4006.34	741	741	1.00	0	0	1.00	0	0	-12449
1+20	1.00	0.00	0	0	1.00	4011.27	742	742	1.00	0	0	1.00	0	0	-13191
1+25	1.00	0.00	0	0	1.00	4014.42	743	743	1.00	0	0	1.00	0	0	-13934
1+30	1.00	0.00	0	0	1.00	4018.99	744	744	1.00	0	0	1.00	0	0	-14678
1+35	1.00	0.00	0	0	1.00	4034.09	746	746	1.00	0	0	1.00	0	0	-15424
1+40	1.00	0.00	0	0	1.00	4060.24	749	749	1.00	0	0	1.00	0	0	-16173
1+45	1.00	0.00	0	0	1.00	3907.85	738	738	1.00	0	0	1.00	0	0	-16911
1+50	1.00	0.00	0	0	1.00	3426.23	679	679	1.00	0	0	1.00	0	0	-17590
1+55	1.00	0.00	0	0	1.00	2891.42	585	585	1.00	0	0	1.00	0	0	-18175
1+60	1.00	0.00	0	0	1.00	2285.37	479	479	1.00	0	0	1.00	0	0	-18654
1+65	1.00	0.00	0	0	1.00	1621.81	362	362	1.00	0	0	1.00	0	0	-19016
1+70	1.00	0.00	0	0	1.00	963.49	239	239	1.00	0	0	1.00	0	0	-19255
1+75	1.00	0.00	0	0	1.00	381.81	125	125	1.00	0	0	1.00	0	0	-19380
1+80	1.00	0.00	0	0	1.00	2.61	36	36	1.00	0	0	1.00	0	0	-19416
1+81	1.00	0.00	0	0	1.00	0.00	0	0	1.00	0	0	1.00	0	0	-19416

RAVENNA ARMY AMMUNITION PLANT

PILE 8

VOLUME REPORTS

Triangle Volume Report

Original Surface: toe8
Design Surface: raven8

Cut (cu yd)	Fill (cu yd)	Net (cu yd)
0.00	14288.86	-14288.86

Grid Volume Report

Original Surface: toe8
Design Surface: raven8

Cut (cu yd)	Fill (cu yd)	Net (cu yd)
0.00	14288.18	-14288.18

ALIGNMENT: 8
SURFACE 1: toe8
SURFACE 2: raven8

									ADJ ********* ADDED QUANTITIES						
BASELINE STATION NUMBER	STAT CUT FACT	STAT CUT AREA	STAT CUT VOL	ADJ STAT CUT VOL	STAT FILL FACT	STAT FILL AREA	STAT FILL VOL	ADJ STAT FILL VOL	ADJ CUT FACT	CUT VOL	CUT VOL	FILL FACT	FILL VOL	ADJUSTED FILL VOL	MASS ORDINATE VOLUME
0+00	1.00	0.00	0	0	1.00	0.00	0	0	1.00	0	0	1.00	0	0	0
0+05	1.00	0.00	0	0	1.00	8.12	1	1	1.00	0	0	1.00	0	0	-1
0+10	1.00	0.00	0	0	1.00	31.29	4	4	1.00	0	0	1.00	0	0	-4
0+15	1.00	0.00	0	0	1.00	67.06	9	9	1.00	0	0	1.00	0	0	-14
0+20	1.00	0.00	0	0	1.00	107.87	16	16	1.00	0	0	1.00	0	0	-30
0+25	1.00	0.00	0	0	1.00	144.13	23	23	1.00	0	0	1.00	0	0	-53
0+30	1.00	0.00	0	0	1.00	172.96	29	29	1.00	0	0	1.00	0	0	-82
0+35	1.00	0.00	0	0	1.00	191.33	34	34	1.00	0	0	1.00	0	0	-116
0+40	1.00	0.00	0	0	1.00	201.70	36	36	1.00	0	0	1.00	0	0	-153
0+45	1.00	0.00	0	0	1.00	204.54	38	38	1.00	0	0	1.00	0	0	-190
0+50	1.00	0.00	0	0	1.00	212.51	39	39	1.00	0	0	1.00	0	0	-229
0+55	1.00	0.00	0	0	1.00	223.04	40	40	1.00	0	0	1.00	0	0	-269
0+60	1.00	0.00	0	0	1.00	242.54	43	43	1.00	0	0	1.00	0	0	-312
0+65	1.00	0.00	0	0	1.00	276.37	48	48	1.00	0	0	1.00	0	0	-360
0+70	1.00	0.00	0	0	1.00	333.14	56	56	1.00	0	0	1.00	0	0	-417
0+75	1.00	0.00	0	0	1.00	448.96	72	72	1.00	0	0	1.00	0	0	-489
0+80	1.00	0.00	0	0	1.00	508.24	89	89	1.00	0	0	1.00	0	0	-578
0+85	1.00	0.00	0	0	1.00	480.79	92	92	1.00	0	0	1.00	0	0	-669
0+90	1.00	0.00	0	0	1.00	451.44	86	86	1.00	0	0	1.00	0	0	-756
0+95	1.00	0.00	0	0	1.00	458.61	84	84	1.00	0	0	1.00	0	0	-840

ALIGNMENT: 8
SURFACE 1: toe8
SURFACE 2: raven8

					ADJ				ADJ ********* ADDED QUANTITIES						
BASELINE	STAT	STAT	STAT	STAT	STAT	STAT	STAT	STAT	ADJ					ADJUSTED	MASS
STATION	CUT	CUT	CUT	CUT	FILL	FILL	FILL	FILL	CUT	CUT	CUT	FILL	FILL	FILL	ORDINATE
NUMBER	FACT	AREA	VOL	VOL	FACT	AREA	VOL	VOL	FACT	VOL	VOL	FACT	VOL	VOL	VOLUME
1+00	1.00	0.00	0	0	1.00	495.43	88	88	1.00	0	0	1.00	0	0	-928
1+05	1.00	0.00	0	0	1.00	532.56	95	95	1.00	0	0	1.00	0	0	-1023
1+10	1.00	0.00	0	0	1.00	539.83	99	99	1.00	0	0	1.00	0	0	-1123
1+15	1.00	0.00	0	0	1.00	563.82	102	102	1.00	0	0	1.00	0	0	-1225
1+20	1.00	0.00	0	0	1.00	553.96	103	103	1.00	0	0	1.00	0	0	-1328
1+25	1.00	0.00	0	0	1.00	544.84	102	102	1.00	0	0	1.00	0	0	-1430
1+30	1.00	0.00	0	0	1.00	536.64	100	100	1.00	0	0	1.00	0	0	-1530
1+35	1.00	0.00	0	0	1.00	525.07	98	98	1.00	0	0	1.00	0	0	-1629
1+40	1.00	0.00	0	0	1.00	524.05	97	97	1.00	0	0	1.00	0	0	-1726
1+45	1.00	0.00	0	0	1.00	516.63	96	96	1.00	0	0	1.00	0	0	-1822
1+50	1.00	0.00	0	0	1.00	518.14	96	96	1.00	0	0	1.00	0	0	-1918
1+55	1.00	0.00	0	0	1.00	544.79	98	98	1.00	0	0	1.00	0	0	-2016
1+60	1.00	0.00	0	0	1.00	563.88	103	103	1.00	0	0	1.00	0	0	-2119
1+65	1.00	0.00	0	0	1.00	577.24	106	106	1.00	0	0	1.00	0	0	-2225
1+70	1.00	0.00	0	0	1.00	576.97	107	107	1.00	0	0	1.00	0	0	-2331
1+75	1.00	0.00	0	0	1.00	558.96	105	105	1.00	0	0	1.00	0	0	-2437
1+80	1.00	0.00	0	0	1.00	523.05	100	100	1.00	0	0	1.00	0	0	-2537
1+85	1.00	0.00	0	0	1.00	505.31	95	95	1.00	0	0	1.00	0	0	-2632
1+90	1.00	0.00	0	0	1.00	501.63	93	93	1.00	0	0	1.00	0	0	-2725
1+95	1.00	0.00	0	0	1.00	515.09	94	94	1.00	0	0	1.00	0	0	-2819

ALIGNMENT: 8
SURFACE 1: toe8
SURFACE 2: raven8

					ADJ			ADJ ********* ADDED QUANTITIES							
BASELINE STATION NUMBER	STAT CUT FACT	STAT CUT AREA	STAT CUT VOL	STAT CUT VOL	STAT FILL FACT	STAT FILL AREA	STAT FILL VOL	STAT FILL VOL	ADJ CUT FACT	CUT VOL	CUT VOL	FILL FACT	FILL VOL	ADJUSTED FILL VOL	MASS ORDINATE VOLUME
2+00	1.00	0.00	0	0	1.00	528.95	97	97	1.00	0	0	1.00	0	0	-2916
2+05	1.00	0.00	0	0	1.00	540.68	99	99	1.00	0	0	1.00	0	0	-3015
2+10	1.00	0.00	0	0	1.00	566.76	103	103	1.00	0	0	1.00	0	0	-3118
2+15	1.00	0.00	0	0	1.00	598.65	108	108	1.00	0	0	1.00	0	0	-3226
2+20	1.00	0.00	0	0	1.00	595.24	111	111	1.00	0	0	1.00	0	0	-3336
2+25	1.00	0.00	0	0	1.00	607.20	111	111	1.00	0	0	1.00	0	0	-3447
2+30	1.00	0.00	0	0	1.00	593.02	111	111	1.00	0	0	1.00	0	0	-3559
2+35	1.00	0.00	0	0	1.00	582.12	109	109	1.00	0	0	1.00	0	0	-3667
2+40	1.00	0.00	0	0	1.00	575.60	107	107	1.00	0	0	1.00	0	0	-3775
2+45	1.00	0.00	0	0	1.00	586.15	108	108	1.00	0	0	1.00	0	0	-3882
2+50	1.00	0.00	0	0	1.00	618.53	112	112	1.00	0	0	1.00	0	0	-3994
2+55	1.00	0.00	0	0	1.00	653.48	118	118	1.00	0	0	1.00	0	0	-4112
2+60	1.00	0.00	0	0	1.00	675.60	123	123	1.00	0	0	1.00	0	0	-4235
2+65	1.00	0.00	0	0	1.00	689.50	126	126	1.00	0	0	1.00	0	0	-4361
2+70	1.00	0.00	0	0	1.00	678.37	127	127	1.00	0	0	1.00	0	0	-4488
2+75	1.00	0.00	0	0	1.00	657.12	124	124	1.00	0	0	1.00	0	0	-4611
2+80	1.00	0.00	0	0	1.00	634.42	120	120	1.00	0	0	1.00	0	0	-4731
2+85	1.00	0.00	0	0	1.00	627.07	117	117	1.00	0	0	1.00	0	0	-4848
2+90	1.00	0.00	0	0	1.00	613.04	115	115	1.00	0	0	1.00	0	0	-4963
2+95	1.00	0.00	0	0	1.00	601.89	112	112	1.00	0	0	1.00	0	0	-5075

ALIGNMENT: 8
SURFACE 1: toe8
SURFACE 2: raven8

					ADJ				ADJ ********* ADDED QUANTITIES						
BASELINE STATION NUMBER	STAT CUT FACT	STAT CUT AREA	STAT CUT VOL	STAT CUT VOL	STAT FILL FACT	STAT FILL AREA	STAT FILL VOL	STAT FILL VOL	ADJ CUT FACT	CUT VOL	CUT VOL	FILL FACT	FILL VOL	ADJUSTED FILL VOL	MASS ORDINATE VOLUME
3+00	1.00	0.00	0	0	1.00	597.78	111	111	1.00	0	0	1.00	0	0	-5186
3+05	1.00	0.00	0	0	1.00	598.26	111	111	1.00	0	0	1.00	0	0	-5297
3+10	1.00	0.00	0	0	1.00	599.47	111	111	1.00	0	0	1.00	0	0	-5408
3+15	1.00	0.00	0	0	1.00	594.45	111	111	1.00	0	0	1.00	0	0	-5518
3+20	1.00	0.00	0	0	1.00	592.20	110	110	1.00	0	0	1.00	0	0	-5628
3+25	1.00	0.00	0	0	1.00	591.32	110	110	1.00	0	0	1.00	0	0	-5738
3+30	1.00	0.00	0	0	1.00	602.50	111	111	1.00	0	0	1.00	0	0	-5848
3+35	1.00	0.00	0	0	1.00	625.18	114	114	1.00	0	0	1.00	0	0	-5962
3+40	1.00	0.00	0	0	1.00	645.66	118	118	1.00	0	0	1.00	0	0	-6080
3+45	1.00	0.00	0	0	1.00	649.90	120	120	1.00	0	0	1.00	0	0	-6200
3+50	1.00	0.00	0	0	1.00	682.94	123	123	1.00	0	0	1.00	0	0	-6323
3+55	1.00	0.00	0	0	1.00	696.26	128	128	1.00	0	0	1.00	0	0	-6451
3+60	1.00	0.00	0	0	1.00	698.04	129	129	1.00	0	0	1.00	0	0	-6580
3+65	1.00	0.00	0	0	1.00	695.89	129	129	1.00	0	0	1.00	0	0	-6709
3+70	1.00	0.00	0	0	1.00	677.67	127	127	1.00	0	0	1.00	0	0	-6836
3+75	1.00	0.00	0	0	1.00	667.14	125	125	1.00	0	0	1.00	0	0	-6961
3+80	1.00	0.00	0	0	1.00	664.90	123	123	1.00	0	0	1.00	0	0	-7084
3+85	1.00	0.00	0	0	1.00	660.93	123	123	1.00	0	0	1.00	0	0	-7207
3+90	1.00	0.00	0	0	1.00	670.58	123	123	1.00	0	0	1.00	0	0	-7330
3+95	1.00	0.00	0	0	1.00	659.14	123	123	1.00	0	0	1.00	0	0	-7453

ALIGNMENT: 8
SURFACE 1: toe8
SURFACE 2: raven8

					ADJ				ADJ ********* ADDED QUANTITIES						
BASELINE STATION NUMBER	STAT CUT FACT	STAT CUT AREA	STAT CUT VOL	STAT CUT VOL	STAT FILL FACT	STAT FILL AREA	STAT FILL VOL	STAT FILL VOL	ADJ CUT FACT	CUT VOL	CUT VOL	FILL FACT	FILL VOL	ADJUSTED FILL VOL	MASS ORDINATE VOLUME
4+00	1.00	0.00	0	0	1.00	660.48	122	122	1.00	0	0	1.00	0	0	-7575
4+05	1.00	0.00	0	0	1.00	672.55	123	123	1.00	0	0	1.00	0	0	-7699
4+10	1.00	0.00	0	0	1.00	657.33	123	123	1.00	0	0	1.00	0	0	-7822
4+15	1.00	0.00	0	0	1.00	640.35	120	120	1.00	0	0	1.00	0	0	-7942
4+20	1.00	0.00	0	0	1.00	628.64	117	117	1.00	0	0	1.00	0	0	-8059
4+25	1.00	0.00	0	0	1.00	630.61	117	117	1.00	0	0	1.00	0	0	-8176
4+30	1.00	0.00	0	0	1.00	661.05	120	120	1.00	0	0	1.00	0	0	-8296
4+35	1.00	0.00	0	0	1.00	693.52	125	125	1.00	0	0	1.00	0	0	-8421
4+40	1.00	0.00	0	0	1.00	704.71	129	129	1.00	0	0	1.00	0	0	-8551
4+45	1.00	0.00	0	0	1.00	704.81	131	131	1.00	0	0	1.00	0	0	-8681
4+50	1.00	0.00	0	0	1.00	690.60	129	129	1.00	0	0	1.00	0	0	-8810
4+55	1.00	0.00	0	0	1.00	684.84	127	127	1.00	0	0	1.00	0	0	-8938
4+60	1.00	0.00	0	0	1.00	691.06	127	127	1.00	0	0	1.00	0	0	-9065
4+65	1.00	0.00	0	0	1.00	686.27	128	128	1.00	0	0	1.00	0	0	-9193
4+70	1.00	0.00	0	0	1.00	680.80	127	127	1.00	0	0	1.00	0	0	-9319
4+75	1.00	0.00	0	0	1.00	683.94	126	126	1.00	0	0	1.00	0	0	-9446
4+80	1.00	0.00	0	0	1.00	670.92	125	125	1.00	0	0	1.00	0	0	-9571
4+85	1.00	0.00	0	0	1.00	662.21	123	123	1.00	0	0	1.00	0	0	-9694
4+90	1.00	0.00	0	0	1.00	663.16	123	123	1.00	0	0	1.00	0	0	-9817
4+95	1.00	0.00	0	0	1.00	660.93	123	123	1.00	0	0	1.00	0	0	-9940

ALIGNMENT: 8
SURFACE 1: toe8
SURFACE 2: raven8

					ADJ				ADJ ********* ADDED QUANTITIES						
BASELINE STATION NUMBER	STAT CUT FACT	STAT CUT AREA	STAT CUT VOL	STAT CUT VOL	STAT FILL FACT	STAT FILL AREA	STAT FILL VOL	STAT FILL VOL	ADJ CUT FACT	CUT VOL	CUT VOL	FILL FACT	FILL VOL	ADJUSTED FILL VOL	MASS ORDINATE VOLUME
5+00	1.00	0.00	0	0	1.00	659.55	122	122	1.00	0	0	1.00	0	0	-10062
5+05	1.00	0.00	0	0	1.00	643.29	121	121	1.00	0	0	1.00	0	0	-10183
5+10	1.00	0.00	0	0	1.00	626.84	118	118	1.00	0	0	1.00	0	0	-10300
5+15	1.00	0.00	0	0	1.00	597.47	113	113	1.00	0	0	1.00	0	0	-10414
5+20	1.00	0.00	0	0	1.00	530.28	104	104	1.00	0	0	1.00	0	0	-10518
5+25	1.00	0.00	0	0	1.00	495.08	95	95	1.00	0	0	1.00	0	0	-10613
5+30	1.00	0.00	0	0	1.00	509.04	93	93	1.00	0	0	1.00	0	0	-10706
5+35	1.00	0.00	0	0	1.00	515.47	95	95	1.00	0	0	1.00	0	0	-10801
5+40	1.00	0.00	0	0	1.00	514.23	95	95	1.00	0	0	1.00	0	0	-10896
5+45	1.00	0.00	0	0	1.00	515.55	95	95	1.00	0	0	1.00	0	0	-10991
5+50	1.00	0.00	0	0	1.00	524.04	96	96	1.00	0	0	1.00	0	0	-11088
5+55	1.00	0.00	0	0	1.00	524.31	97	97	1.00	0	0	1.00	0	0	-11185
5+60	1.00	0.00	0	0	1.00	519.67	97	97	1.00	0	0	1.00	0	0	-11281
5+65	1.00	0.00	0	0	1.00	520.83	96	96	1.00	0	0	1.00	0	0	-11378
5+70	1.00	0.00	0	0	1.00	484.63	93	93	1.00	0	0	1.00	0	0	-11471
5+75	1.00	0.00	0	0	1.00	468.97	88	88	1.00	0	0	1.00	0	0	-11559
5+80	1.00	0.00	0	0	1.00	468.45	87	87	1.00	0	0	1.00	0	0	-11646
5+85	1.00	0.00	0	0	1.00	501.22	90	90	1.00	0	0	1.00	0	0	-11736
5+90	1.00	0.00	0	0	1.00	531.15	96	96	1.00	0	0	1.00	0	0	-11831
5+95	1.00	0.00	0	0	1.00	543.76	100	100	1.00	0	0	1.00	0	0	-11931

ALIGNMENT: 8
SURFACE 1: toe8
SURFACE 2: raven8

BASELINE STATION NUMBER	STAT CUT FACT	STAT CUT AREA	STAT CUT VOL	STAT CUT VOL	ADJ STAT FILL FACT	STAT FILL AREA	STAT FILL VOL	STAT FILL VOL	ADJ ADJ CUT FACT	CUT VOL	********* ADDED QUANTITIES CUT VOL	FILL FACT	FILL VOL	ADJUSTED FILL VOL	MASS ORDINATE VOLUME
6+00	1.00	0.00	0	0	1.00	554.54	102	102	1.00	0	0	1.00	0	0	-12033
6+05	1.00	0.00	0	0	1.00	568.31	104	104	1.00	0	0	1.00	0	0	-12137
6+10	1.00	0.00	0	0	1.00	556.26	104	104	1.00	0	0	1.00	0	0	-12241
6+15	1.00	0.00	0	0	1.00	550.86	103	103	1.00	0	0	1.00	0	0	-12343
6+20	1.00	0.00	0	0	1.00	555.18	102	102	1.00	0	0	1.00	0	0	-12446
6+25	1.00	0.00	0	0	1.00	555.80	103	103	1.00	0	0	1.00	0	0	-12548
6+30	1.00	0.00	0	0	1.00	545.57	102	102	1.00	0	0	1.00	0	0	-12650
6+35	1.00	0.00	0	0	1.00	538.62	100	100	1.00	0	0	1.00	0	0	-12751
6+40	1.00	0.00	0	0	1.00	551.49	101	101	1.00	0	0	1.00	0	0	-12852
6+45	1.00	0.00	0	0	1.00	567.08	104	104	1.00	0	0	1.00	0	0	-12955
6+50	1.00	0.00	0	0	1.00	580.68	106	106	1.00	0	0	1.00	0	0	-13062
6+55	1.00	0.00	0	0	1.00	561.61	106	106	1.00	0	0	1.00	0	0	-13167
6+60	1.00	0.00	0	0	1.00	560.67	104	104	1.00	0	0	1.00	0	0	-13271
6+65	1.00	0.00	0	0	1.00	547.39	103	103	1.00	0	0	1.00	0	0	-13374
6+70	1.00	0.00	0	0	1.00	519.56	99	99	1.00	0	0	1.00	0	0	-13473
6+75	1.00	0.00	0	0	1.00	483.62	93	93	1.00	0	0	1.00	0	0	-13566
6+80	1.00	0.00	0	0	1.00	449.41	86	86	1.00	0	0	1.00	0	0	-13652
6+85	1.00	0.00	0	0	1.00	418.73	80	80	1.00	0	0	1.00	0	0	-13732
6+90	1.00	0.00	0	0	1.00	401.54	76	76	1.00	0	0	1.00	0	0	-13808
6+95	1.00	0.00	0	0	1.00	386.96	73	73	1.00	0	0	1.00	0	0	-13881

ALIGNMENT: 8
SURFACE 1: toe8
SURFACE 2: raven8

									ADJ ********* ADDED QUANTITIES						
BASELINE STATION NUMBER	STAT CUT FACT	STAT CUT AREA	STAT CUT VOL	STAT CUT VOL	ADJ STAT FILL FACT	STAT FILL AREA	STAT FILL VOL	STAT FILL VOL	ADJ CUT FACT	CUT VOL	CUT VOL	FILL FACT	FILL VOL	ADJUSTED FILL VOL	MASS ORDINATE VOLUME
7+00	1.00	0.00	0	0	1.00	376.48	71	71	1.00	0	0	1.00	0	0	-13952
7+05	1.00	0.00	0	0	1.00	353.43	68	68	1.00	0	0	1.00	0	0	-14020
7+10	1.00	0.00	0	0	1.00	314.39	62	62	1.00	0	0	1.00	0	0	-14081
7+15	1.00	0.00	0	0	1.00	278.99	55	55	1.00	0	0	1.00	0	0	-14136
7+20	1.00	0.00	0	0	1.00	240.00	48	48	1.00	0	0	1.00	0	0	-14184
7+25	1.00	0.00	0	0	1.00	209.46	42	42	1.00	0	0	1.00	0	0	-14226
7+30	1.00	0.00	0	0	1.00	143.26	33	33	1.00	0	0	1.00	0	0	-14259
7+35	1.00	0.00	0	0	1.00	74.60	20	20	1.00	0	0	1.00	0	0	-14279
7+40	1.00	0.00	0	0	1.00	24.61	9	9	1.00	0	0	1.00	0	0	-14288
7+45	1.00	0.00	0	0	1.00	0.00	2	2	1.00	0	0	1.00	0	0	-14290
7+48	1.00	0.00	0	0	1.00	0.00	0	0	1.00	0	0	1.00	0	0	-14290

RAVENNA ARMY AMMUNITION PLANT

PILE 20

VOLUME REPORTS

Triangle Volume Report

Original Surface: toe20
Design Surface: raven20

Cut (cu yd)	Fill (cu yd)	Net (cu yd)
0.00	8533.38	-8533.38

Grid Volume Report

Original Surface: toe20
Design Surface: raven20

Cut (cu yd)	Fill (cu yd)	Net (cu yd)
0.97	8532.46	-8531.49

ALIGNMENT: 20
SURFACE 1: toe20
SURFACE 2: raven20

BASELINE STATION NUMBER	STAT CUT FACT	STAT CUT AREA	STAT CUT VOL	ADJ STAT CUT VOL	STAT FILL FACT	STAT FILL AREA	STAT FILL VOL	ADJ STAT FILL VOL	ADJ CUT FACT (********* ADDED QUANTITIES)	CUT VOL	CUT VOL	FILL FACT	FILL VOL	ADJUSTED FILL VOL	MASS ORDINATE VOLUME
0+00	1.00	0.00	0	0	1.00	0.00	0	0	1.00	0	0	1.00	0	0	0
0+05	1.00	0.00	0	0	1.00	0.00	0	0	1.00	0	0	1.00	0	0	0
0+10	1.00	0.00	0	0	1.00	1.78	0	0	1.00	0	0	1.00	0	0	-0
0+15	1.00	0.00	0	0	1.00	11.56	1	1	1.00	0	0	1.00	0	0	-1
0+20	1.00	0.00	0	0	1.00	31.33	4	4	1.00	0	0	1.00	0	0	-5
0+25	1.00	0.00	0	0	1.00	51.38	8	8	1.00	0	0	1.00	0	0	-13
0+30	1.00	0.00	0	0	1.00	72.23	11	11	1.00	0	0	1.00	0	0	-24
0+35	1.00	0.00	0	0	1.00	92.60	15	15	1.00	0	0	1.00	0	0	-40
0+40	1.00	0.00	0	0	1.00	99.91	18	18	1.00	0	0	1.00	0	0	-58
0+45	1.00	0.00	0	0	1.00	102.93	19	19	1.00	0	0	1.00	0	0	-76
0+50	1.00	0.00	0	0	1.00	125.30	21	21	1.00	0	0	1.00	0	0	-97
0+55	1.00	0.00	0	0	1.00	160.53	26	26	1.00	0	0	1.00	0	0	-124
0+60	1.00	0.00	0	0	1.00	183.49	32	32	1.00	0	0	1.00	0	0	-156
0+65	1.00	0.00	0	0	1.00	188.09	34	34	1.00	0	0	1.00	0	0	-190
0+70	1.00	0.00	0	0	1.00	188.28	35	35	1.00	0	0	1.00	0	0	-225
0+75	1.00	0.00	0	0	1.00	189.36	35	35	1.00	0	0	1.00	0	0	-260
0+80	1.00	0.00	0	0	1.00	182.30	34	34	1.00	0	0	1.00	0	0	-294
0+85	1.00	0.00	0	0	1.00	187.81	34	34	1.00	0	0	1.00	0	0	-329
0+90	1.00	0.00	0	0	1.00	191.59	35	35	1.00	0	0	1.00	0	0	-364
0+95	1.00	0.00	0	0	1.00	197.23	36	36	1.00	0	0	1.00	0	0	-400

ALIGNMENT: 20
SURFACE 1: toe20
SURFACE 2: raven20

									ADJ ********* ADDED QUANTITIES						
BASELINE STATION NUMBER	STAT CUT FACT	STAT CUT AREA	STAT CUT VOL	STAT CUT VOL	ADJ STAT FILL FACT	STAT FILL AREA	STAT FILL VOL	STAT FILL VOL	ADJ CUT FACT	CUT VOL	CUT VOL	FILL FACT	FILL VOL	ADJUSTED FILL VOL	MASS ORDINATE VOLUME
1+00	1.00	0.00	0	0	1.00	204.18	37	37	1.00	0	0	1.00	0	0	-437
1+05	1.00	0.00	0	0	1.00	211.68	39	39	1.00	0	0	1.00	0	0	-476
1+10	1.00	0.00	0	0	1.00	219.48	40	40	1.00	0	0	1.00	0	0	-515
1+15	1.00	0.00	0	0	1.00	218.66	41	41	1.00	0	0	1.00	0	0	-556
1+20	1.00	0.00	0	0	1.00	236.23	42	42	1.00	0	0	1.00	0	0	-598
1+25	1.00	0.00	0	0	1.00	253.62	45	45	1.00	0	0	1.00	0	0	-643
1+30	1.00	0.00	0	0	1.00	257.14	47	47	1.00	0	0	1.00	0	0	-691
1+35	1.00	0.00	0	0	1.00	252.78	47	47	1.00	0	0	1.00	0	0	-738
1+40	1.00	0.00	0	0	1.00	256.00	47	47	1.00	0	0	1.00	0	0	-785
1+45	1.00	0.00	0	0	1.00	266.73	48	48	1.00	0	0	1.00	0	0	-833
1+50	1.00	0.00	0	0	1.00	274.41	50	50	1.00	0	0	1.00	0	0	-884
1+55	1.00	0.00	0	0	1.00	288.39	52	52	1.00	0	0	1.00	0	0	-936
1+60	1.00	0.00	0	0	1.00	308.84	55	55	1.00	0	0	1.00	0	0	-991
1+65	1.00	0.00	0	0	1.00	325.24	59	59	1.00	0	0	1.00	0	0	-1050
1+70	1.00	0.00	0	0	1.00	326.91	60	60	1.00	0	0	1.00	0	0	-1110
1+75	1.00	0.00	0	0	1.00	331.79	61	61	1.00	0	0	1.00	0	0	-1171
1+80	1.00	0.00	0	0	1.00	339.56	62	62	1.00	0	0	1.00	0	0	-1233
1+85	1.00	0.00	0	0	1.00	349.11	64	64	1.00	0	0	1.00	0	0	-1297
1+90	1.00	0.00	0	0	1.00	354.03	65	65	1.00	0	0	1.00	0	0	-1362
1+95	1.00	0.00	0	0	1.00	355.82	66	66	1.00	0	0	1.00	0	0	-1428

ALIGNMENT: 20
SURFACE 1: toe20
SURFACE 2: raven20

					ADJ				ADJ ********* ADDED QUANTITIES							
BASELINE STATION NUMBER	STAT CUT FACT	STAT CUT AREA	STAT CUT VOL	STAT CUT VOL	STAT FILL FACT	STAT FILL AREA	STAT FILL VOL	STAT FILL VOL	ADJ CUT FACT	CUT VOL	CUT VOL	FILL FACT	FILL VOL	ADJUSTED FILL VOL	MASS ORDINATE VOLUME
2+00	1.00	0.00	0	0	1.00	349.15	65	65	1.00	0	0	1.00	0	0	-1493
2+05	1.00	0.00	0	0	1.00	341.06	64	64	1.00	0	0	1.00	0	0	-1557
2+10	1.00	0.00	0	0	1.00	341.45	63	63	1.00	0	0	1.00	0	0	-1620
2+15	1.00	0.00	0	0	1.00	336.26	63	63	1.00	0	0	1.00	0	0	-1683
2+20	1.00	0.00	0	0	1.00	330.55	62	62	1.00	0	0	1.00	0	0	-1745
2+25	1.00	0.00	0	0	1.00	330.04	61	61	1.00	0	0	1.00	0	0	-1806
2+30	1.00	0.00	0	0	1.00	342.10	62	62	1.00	0	0	1.00	0	0	-1868
2+35	1.00	0.00	0	0	1.00	357.78	65	65	1.00	0	0	1.00	0	0	-1933
2+40	1.00	0.00	0	0	1.00	360.27	66	66	1.00	0	0	1.00	0	0	-1999
2+45	1.00	0.00	0	0	1.00	353.86	66	66	1.00	0	0	1.00	0	0	-2066
2+50	1.00	0.00	0	0	1.00	345.96	65	65	1.00	0	0	1.00	0	0	-2130
2+55	1.00	0.00	0	0	1.00	342.38	64	64	1.00	0	0	1.00	0	0	-2194
2+60	1.00	0.00	0	0	1.00	343.88	64	64	1.00	0	0	1.00	0	0	-2258
2+65	1.00	0.00	0	0	1.00	350.91	64	64	1.00	0	0	1.00	0	0	-2322
2+70	1.00	0.00	0	0	1.00	356.13	65	65	1.00	0	0	1.00	0	0	-2387
2+75	1.00	0.00	0	0	1.00	356.61	66	66	1.00	0	0	1.00	0	0	-2453
2+80	1.00	0.00	0	0	1.00	357.82	66	66	1.00	0	0	1.00	0	0	-2520
2+85	1.00	0.00	0	0	1.00	358.73	66	66	1.00	0	0	1.00	0	0	-2586
2+90	1.00	0.00	0	0	1.00	359.52	67	67	1.00	0	0	1.00	0	0	-2652
2+95	1.00	0.00	0	0	1.00	371.64	68	68	1.00	0	0	1.00	0	0	-2720

ALIGNMENT: 20
SURFACE 1: toe20
SURFACE 2: raven20

BASELINE STATION NUMBER	STAT CUT FACT	STAT CUT AREA	STAT CUT VOL	STAT CUT VOL	ADJ STAT FILL FACT	STAT FILL AREA	STAT FILL VOL	STAT FILL VOL	ADJ ********* ADDED QUANTITIES ADJ CUT FACT	CUT VOL	CUT VOL	FILL FACT	FILL VOL	ADJUSTED FILL VOL	MASS ORDINATE VOLUME
3+00	1.00	0.00	0	0	1.00	380.31	70	70	1.00	0	0	1.00	0	0	-2790
3+05	1.00	0.00	0	0	1.00	379.89	70	70	1.00	0	0	1.00	0	0	-2860
3+10	1.00	0.00	0	0	1.00	393.80	72	72	1.00	0	0	1.00	0	0	-2932
3+15	1.00	0.00	0	0	1.00	409.48	74	74	1.00	0	0	1.00	0	0	-3006
3+20	1.00	0.00	0	0	1.00	417.01	77	77	1.00	0	0	1.00	0	0	-3083
3+25	1.00	0.00	0	0	1.00	415.04	77	77	1.00	0	0	1.00	0	0	-3160
3+30	1.00	0.00	0	0	1.00	402.73	76	76	1.00	0	0	1.00	0	0	-3235
3+35	1.00	0.00	0	0	1.00	392.69	74	74	1.00	0	0	1.00	0	0	-3309
3+40	1.00	0.00	0	0	1.00	389.41	72	72	1.00	0	0	1.00	0	0	-3381
3+45	1.00	0.00	0	0	1.00	390.61	72	72	1.00	0	0	1.00	0	0	-3454
3+50	1.00	0.00	0	0	1.00	393.15	73	73	1.00	0	0	1.00	0	0	-3526
3+55	1.00	0.00	0	0	1.00	400.69	74	74	1.00	0	0	1.00	0	0	-3600
3+60	1.00	0.00	0	0	1.00	402.65	74	74	1.00	0	0	1.00	0	0	-3674
3+65	1.00	0.00	0	0	1.00	395.68	74	74	1.00	0	0	1.00	0	0	-3748
3+70	1.00	0.00	0	0	1.00	387.60	73	73	1.00	0	0	1.00	0	0	-3821
3+75	1.00	0.00	0	0	1.00	390.17	72	72	1.00	0	0	1.00	0	0	-3893
3+80	1.00	0.00	0	0	1.00	403.97	74	74	1.00	0	0	1.00	0	0	-3966
3+85	1.00	0.00	0	0	1.00	415.66	76	76	1.00	0	0	1.00	0	0	-4042
3+90	1.00	0.00	0	0	1.00	417.85	77	77	1.00	0	0	1.00	0	0	-4119
3+95	1.00	0.00	0	0	1.00	403.60	76	76	1.00	0	0	1.00	0	0	-4195

ALIGNMENT: 20
SURFACE 1: toe20
SURFACE 2: raven20

									ADJ ********* ADDED QUANTITIES						
BASELINE STATION NUMBER	STAT CUT FACT	STAT CUT AREA	STAT CUT VOL	STAT CUT VOL	ADJ STAT FILL FACT	STAT FILL AREA	STAT FILL VOL	STAT FILL VOL	ADJ CUT FACT	CUT VOL	CUT VOL	FILL FACT	FILL VOL	ADJUSTED FILL VOL	MASS ORDINATE VOLUME
4+00	1.00	0.00	0	0	1.00	391.60	74	74	1.00	0	0	1.00	0	0	-4269
4+05	1.00	0.00	0	0	1.00	393.35	73	73	1.00	0	0	1.00	0	0	-4342
4+10	1.00	0.00	0	0	1.00	399.64	73	73	1.00	0	0	1.00	0	0	-4415
4+15	1.00	0.00	0	0	1.00	410.15	75	75	1.00	0	0	1.00	0	0	-4490
4+20	1.00	0.00	0	0	1.00	408.23	76	76	1.00	0	0	1.00	0	0	-4566
4+25	1.00	0.00	0	0	1.00	403.62	75	75	1.00	0	0	1.00	0	0	-4641
4+30	1.00	0.00	0	0	1.00	402.15	75	75	1.00	0	0	1.00	0	0	-4716
4+35	1.00	0.00	0	0	1.00	408.15	75	75	1.00	0	0	1.00	0	0	-4791
4+40	1.00	0.00	0	0	1.00	420.21	77	77	1.00	0	0	1.00	0	0	-4867
4+45	1.00	0.00	0	0	1.00	419.96	78	78	1.00	0	0	1.00	0	0	-4945
4+50	1.00	0.00	0	0	1.00	416.99	77	77	1.00	0	0	1.00	0	0	-5023
4+55	1.00	0.00	0	0	1.00	420.97	78	78	1.00	0	0	1.00	0	0	-5100
4+60	1.00	0.00	0	0	1.00	426.20	78	78	1.00	0	0	1.00	0	0	-5179
4+65	1.00	0.00	0	0	1.00	427.28	79	79	1.00	0	0	1.00	0	0	-5258
4+70	1.00	0.00	0	0	1.00	423.69	79	79	1.00	0	0	1.00	0	0	-5336
4+75	1.00	0.00	0	0	1.00	413.54	78	78	1.00	0	0	1.00	0	0	-5414
4+80	1.00	0.00	0	0	1.00	404.72	76	76	1.00	0	0	1.00	0	0	-5490
4+85	1.00	0.00	0	0	1.00	400.56	75	75	1.00	0	0	1.00	0	0	-5564
4+90	1.00	0.00	0	0	1.00	394.28	74	74	1.00	0	0	1.00	0	0	-5638
4+95	1.00	0.00	0	0	1.00	389.12	73	73	1.00	0	0	1.00	0	0	-5710

ALIGNMENT: 20
SURFACE 1: toe20
SURFACE 2: raven20

BASELINE STATION NUMBER	STAT CUT FACT	STAT CUT AREA	STAT CUT VOL	STAT CUT VOL	ADJ STAT FILL FACT	STAT FILL AREA	STAT FILL VOL	STAT FILL VOL	ADJ ADJ CUT FACT	********* ADDED QUANTITIES CUT VOL	ADJUSTED MASS CUT VOL	FILL FACT	FILL VOL	FILL VOL	ORDINATE VOLUME
5+00	1.00	0.00	0	0	1.00	381.76	71	71	1.00	0	0	1.00	0	0	-5782
5+05	1.00	0.00	0	0	1.00	385.53	71	71	1.00	0	0	1.00	0	0	-5853
5+10	1.00	0.00	0	0	1.00	394.39	72	72	1.00	0	0	1.00	0	0	-5925
5+15	1.00	0.00	0	0	1.00	402.65	74	74	1.00	0	0	1.00	0	0	-5999
5+20	1.00	0.00	0	0	1.00	409.27	75	75	1.00	0	0	1.00	0	0	-6074
5+25	1.00	0.00	0	0	1.00	416.35	76	76	1.00	0	0	1.00	0	0	-6150
5+30	1.00	0.00	0	0	1.00	441.26	79	79	1.00	0	0	1.00	0	0	-6230
5+35	1.00	0.00	0	0	1.00	451.87	83	83	1.00	0	0	1.00	0	0	-6313
5+40	1.00	0.00	0	0	1.00	451.49	84	84	1.00	0	0	1.00	0	0	-6396
5+45	1.00	0.00	0	0	1.00	446.89	83	83	1.00	0	0	1.00	0	0	-6479
5+50	1.00	0.00	0	0	1.00	443.32	82	82	1.00	0	0	1.00	0	0	-6562
5+55	1.00	0.00	0	0	1.00	439.58	82	82	1.00	0	0	1.00	0	0	-6644
5+60	1.00	0.00	0	0	1.00	433.51	81	81	1.00	0	0	1.00	0	0	-6724
5+65	1.00	0.00	0	0	1.00	426.22	80	80	1.00	0	0	1.00	0	0	-6804
5+70	1.00	0.00	0	0	1.00	419.11	78	78	1.00	0	0	1.00	0	0	-6882
5+75	1.00	0.00	0	0	1.00	389.68	75	75	1.00	0	0	1.00	0	0	-6957
5+80	1.00	0.00	0	0	1.00	346.27	68	68	1.00	0	0	1.00	0	0	-7025
5+85	1.00	0.00	0	0	1.00	298.70	60	60	1.00	0	0	1.00	0	0	-7085
5+90	1.00	0.00	0	0	1.00	291.91	55	55	1.00	0	0	1.00	0	0	-7140
5+95	1.00	0.00	0	0	1.00	293.24	54	54	1.00	0	0	1.00	0	0	-7194

ALIGNMENT: 20
SURFACE 1: toe20
SURFACE 2: raven20

					ADJ				ADJ ********* ADDED QUANTITIES						
BASELINE	STAT	STAT	STAT	STAT	STAT	STAT	STAT	STAT	ADJ		ADJUSTED MASS				
STATION	CUT	CUT	CUT	CUT	FILL	FILL	FILL	FILL	CUT	CUT	CUT	FILL	FILL	FILL	ORDINATE
NUMBER	FACT	AREA	VOL	VOL	FACT	AREA	VOL	VOL	FACT	VOL	VOL	FACT	VOL	VOL	VOLUME
6+00	1.00	0.00	0	0	1.00	282.96	53	53	1.00	0	0	1.00	0	0	-7247
6+05	1.00	0.00	0	0	1.00	265.11	51	51	1.00	0	0	1.00	0	0	-7298
6+10	1.00	0.00	0	0	1.00	244.70	47	47	1.00	0	0	1.00	0	0	-7345
6+15	1.00	0.00	0	0	1.00	224.56	43	43	1.00	0	0	1.00	0	0	-7389
6+20	1.00	0.00	0	0	1.00	205.27	40	40	1.00	0	0	1.00	0	0	-7428
6+25	1.00	0.00	0	0	1.00	177.69	35	35	1.00	0	0	1.00	0	0	-7464
6+30	1.00	0.00	0	0	1.00	161.57	31	31	1.00	0	0	1.00	0	0	-7495
6+35	1.00	0.00	0	0	1.00	146.56	29	29	1.00	0	0	1.00	0	0	-7524
6+40	1.00	0.00	0	0	1.00	136.41	26	26	1.00	0	0	1.00	0	0	-7550
6+45	1.00	0.00	0	0	1.00	127.53	24	24	1.00	0	0	1.00	0	0	-7575
6+50	1.00	0.00	0	0	1.00	119.98	23	23	1.00	0	0	1.00	0	0	-7597
6+55	1.00	0.00	0	0	1.00	117.13	22	22	1.00	0	0	1.00	0	0	-7619
6+60	1.00	0.00	0	0	1.00	110.14	21	21	1.00	0	0	1.00	0	0	-7640
6+65	1.00	0.00	0	0	1.00	108.07	20	20	1.00	0	0	1.00	0	0	-7661
6+70	1.00	0.00	0	0	1.00	100.26	19	19	1.00	0	0	1.00	0	0	-7680
6+75	1.00	0.00	0	0	1.00	92.08	18	18	1.00	0	0	1.00	0	0	-7698
6+80	1.00	0.00	0	0	1.00	88.28	17	17	1.00	0	0	1.00	0	0	-7714
6+85	1.00	0.00	0	0	1.00	81.47	16	16	1.00	0	0	1.00	0	0	-7730
6+90	1.00	0.00	0	0	1.00	71.77	14	14	1.00	0	0	1.00	0	0	-7744
6+95	1.00	0.00	0	0	1.00	57.43	12	12	1.00	0	0	1.00	0	0	-7756

ALIGNMENT: 20
SURFACE 1: toe20
SURFACE 2: raven20

BASELINE STATION NUMBER	STAT CUT FACT	STAT CUT AREA	STAT CUT VOL	STAT CUT VOL	ADJ STAT FILL FACT	STAT FILL AREA	STAT FILL VOL	STAT FILL VOL	ADJ ********* ADDED QUANTITIES ADJ CUT FACT	CUT VOL	ADJUSTED MASS CUT VOL	FILL FACT	FILL VOL	FILL VOL	ORDINATE VOLUME
7+00	1.00	0.00	0	0	1.00	58.96	11	11	1.00	0	0	1.00	0	0	-7767
7+05	1.00	0.00	0	0	1.00	58.22	11	11	1.00	0	0	1.00	0	0	-7778
7+10	1.00	0.00	0	0	1.00	55.62	11	11	1.00	0	0	1.00	0	0	-7788
7+15	1.00	0.00	0	0	1.00	51.67	10	10	1.00	0	0	1.00	0	0	-7798
7+20	1.00	0.00	0	0	1.00	52.28	10	10	1.00	0	0	1.00	0	0	-7808
7+25	1.00	0.00	0	0	1.00	61.54	11	11	1.00	0	0	1.00	0	0	-7819
7+30	1.00	0.00	0	0	1.00	59.18	11	11	1.00	0	0	1.00	0	0	-7830
7+35	1.00	0.00	0	0	1.00	55.67	11	11	1.00	0	0	1.00	0	0	-7840
7+40	1.00	0.00	0	0	1.00	54.94	10	10	1.00	0	0	1.00	0	0	-7851
7+45	1.00	0.00	0	0	1.00	58.32	10	10	1.00	0	0	1.00	0	0	-7861
7+50	1.00	0.00	0	0	1.00	63.76	11	11	1.00	0	0	1.00	0	0	-7872
7+55	1.00	0.00	0	0	1.00	82.70	14	14	1.00	0	0	1.00	0	0	-7886
7+60	1.00	0.00	0	0	1.00	99.20	17	17	1.00	0	0	1.00	0	0	-7903
7+65	1.00	0.00	0	0	1.00	116.80	20	20	1.00	0	0	1.00	0	0	-7923
7+70	1.00	0.00	0	0	1.00	136.65	23	23	1.00	0	0	1.00	0	0	-7946
7+75	1.00	0.00	0	0	1.00	160.60	28	28	1.00	0	0	1.00	0	0	-7974
7+80	1.00	0.00	0	0	1.00	172.80	31	31	1.00	0	0	1.00	0	0	-8005
7+85	1.00	0.00	0	0	1.00	176.18	32	32	1.00	0	0	1.00	0	0	-8037
7+90	1.00	0.00	0	0	1.00	166.88	32	32	1.00	0	0	1.00	0	0	-8069
7+95	1.00	0.00	0	0	1.00	153.28	30	30	1.00	0	0	1.00	0	0	-8098

ALIGNMENT: 20
SURFACE 1: toe20
SURFACE 2: raven20

					ADJ				ADJ ********* ADDED QUANTITIES						
BASELINE	STAT	STAT	STAT	STAT	STAT	STAT	STAT	STAT	ADJ		ADJUSTED MASS				
STATION	CUT	CUT	CUT	CUT	FILL	FILL	FILL	FILL	CUT	CUT	CUT	FILL	FILL	FILL	ORDINATE
NUMBER	FACT	AREA	VOL	VOL	FACT	AREA	VOL	VOL	FACT	VOL	VOL	FACT	VOL	VOL	VOLUME
8+00	1.00	0.00	0	0	1.00	136.27	27	27	1.00	0	0	1.00	0	0	-8125
8+05	1.00	0.00	0	0	1.00	116.07	23	23	1.00	0	0	1.00	0	0	-8149
8+10	1.00	0.00	0	0	1.00	101.67	20	20	1.00	0	0	1.00	0	0	-8169
8+15	1.00	0.00	0	0	1.00	94.02	18	18	1.00	0	0	1.00	0	0	-8187
8+20	1.00	0.00	0	0	1.00	102.69	18	18	1.00	0	0	1.00	0	0	-8205
8+25	1.00	0.00	0	0	1.00	107.57	19	19	1.00	0	0	1.00	0	0	-8225
8+30	1.00	0.00	0	0	1.00	103.73	20	20	1.00	0	0	1.00	0	0	-8244
8+35	1.00	0.00	0	0	1.00	96.64	19	19	1.00	0	0	1.00	0	0	-8263
8+40	1.00	0.00	0	0	1.00	72.62	16	16	1.00	0	0	1.00	0	0	-8278
8+45	1.00	0.00	0	0	1.00	52.55	12	12	1.00	0	0	1.00	0	0	-8290
8+50	1.00	0.00	0	0	1.00	48.09	9	9	1.00	0	0	1.00	0	0	-8299
8+55	1.00	0.00	0	0	1.00	41.02	8	8	1.00	0	0	1.00	0	0	-8307
8+60	1.00	0.00	0	0	1.00	34.87	7	7	1.00	0	0	1.00	0	0	-8315
8+65	1.00	0.00	0	0	1.00	28.47	6	6	1.00	0	0	1.00	0	0	-8320
8+70	1.00	0.00	0	0	1.00	25.11	5	5	1.00	0	0	1.00	0	0	-8325
8+75	1.00	0.00	0	0	1.00	25.84	5	5	1.00	0	0	1.00	0	0	-8330
8+80	1.00	0.00	0	0	1.00	23.80	5	5	1.00	0	0	1.00	0	0	-8335
8+85	1.00	0.00	0	0	1.00	23.40	4	4	1.00	0	0	1.00	0	0	-8339
8+90	1.00	0.00	0	0	1.00	23.57	4	4	1.00	0	0	1.00	0	0	-8343
8+95	1.00	0.00	0	0	1.00	31.78	5	5	1.00	0	0	1.00	0	0	-8348

ALIGNMENT: 20
SURFACE 1: toe20
SURFACE 2: raven20

					ADJ				ADJ	********* ADDED QUANTITIES					
BASELINE	STAT	STAT	STAT	STAT	STAT	STAT	STAT	STAT	ADJ		ADJUSTED MASS				
STATION	CUT	CUT	CUT	CUT	FILL	FILL	FILL	FILL	CUT	CUT	CUT	FILL	FILL	FILL	ORDINATE
NUMBER	FACT	AREA	VOL	VOL	FACT	AREA	VOL	VOL	FACT	VOL	VOL	FACT	VOL	VOL	VOLUME
9+00	1.00	0.00	0	0	1.00	35.52	6	6	1.00	0	0	1.00	0	0	-8355
9+05	1.00	0.00	0	0	1.00	29.30	6	6	1.00	0	0	1.00	0	0	-8361
9+10	1.00	0.00	0	0	1.00	41.37	7	7	1.00	0	0	1.00	0	0	-8367
9+15	1.00	0.00	0	0	1.00	68.04	10	10	1.00	0	0	1.00	0	0	-8377
9+20	1.00	0.00	0	0	1.00	69.76	13	13	1.00	0	0	1.00	0	0	-8390
9+25	1.00	0.00	0	0	1.00	73.03	13	13	1.00	0	0	1.00	0	0	-8403
9+30	1.00	0.00	0	0	1.00	69.41	13	13	1.00	0	0	1.00	0	0	-8417
9+35	1.00	0.00	0	0	1.00	52.26	11	11	1.00	0	0	1.00	0	0	-8428
9+40	1.00	0.00	0	0	1.00	62.05	11	11	1.00	0	0	1.00	0	0	-8438
9+45	1.00	0.00	0	0	1.00	77.22	13	13	1.00	0	0	1.00	0	0	-8451
9+50	1.00	0.00	0	0	1.00	83.89	15	15	1.00	0	0	1.00	0	0	-8466
9+55	1.00	0.00	0	0	1.00	80.79	15	15	1.00	0	0	1.00	0	0	-8481
9+60	1.00	0.00	0	0	1.00	75.00	14	14	1.00	0	0	1.00	0	0	-8496
9+65	1.00	0.00	0	0	1.00	71.82	14	14	1.00	0	0	1.00	0	0	-8510
9+70	1.00	0.00	0	0	1.00	61.59	12	12	1.00	0	0	1.00	0	0	-8522
9+75	1.00	0.00	0	0	1.00	28.95	8	8	1.00	0	0	1.00	0	0	-8530
9+80	1.00	0.00	0	0	1.00	5.49	3	3	1.00	0	0	1.00	0	0	-8533
9+85	1.00	0.00	0	0	1.00	0.00	1	1	1.00	0	0	1.00	0	0	-8534
9+88	1.00	0.00	0	0	1.00	0.00	0	0	1.00	0	0	1.00	0	0	-8534

RAVENNA ARMY AMMUNITION PLANT

PILE 22

VOLUME REPORTS

Triangle Volume Report

Original Surface: toe22
Design Surface: raven22

Cut (cu yd)	Fill (cu yd)	Net (cu yd)
0.05	7459.59	-7459.54

Grid Volume Report

Original Surface: toe22
Design Surface: raven22

Cut (cu yd)	Fill (cu yd)	Net (cu yd)
0.02	7455.95	-7455.93

ALIGNMENT: 22
SURFACE 1: toe22
SURFACE 2: raven22

BASELINE STATION NUMBER	STAT CUT FACT	STAT CUT AREA	STAT CUT VOL	ADJ STAT CUT VOL	STAT FILL FACT	STAT FILL AREA	STAT FILL VOL	ADJ STAT FILL VOL	********* ADDED QUANTITIES ADJ CUT FACT	CUT VOL	CUT VOL	FILL FACT	FILL VOL	ADJUSTED FILL VOL	MASS ORDINATE VOLUME
0+00	1.00	0.00	0	0	1.00	0.00	0	0	1.00	0	0	1.00	0	0	0
0+05	1.00	0.00	0	0	1.00	143.17	13	13	1.00	0	0	1.00	0	0	-13
0+10	1.00	0.00	0	0	1.00	337.66	45	45	1.00	0	0	1.00	0	0	-58
0+15	1.00	0.00	0	0	1.00	515.74	79	79	1.00	0	0	1.00	0	0	-137
0+20	1.00	0.00	0	0	1.00	619.28	105	105	1.00	0	0	1.00	0	0	-242
0+25	1.00	0.00	0	0	1.00	688.53	121	121	1.00	0	0	1.00	0	0	-363
0+30	1.00	0.00	0	0	1.00	743.83	133	133	1.00	0	0	1.00	0	0	-496
0+35	1.00	0.00	0	0	1.00	786.46	142	142	1.00	0	0	1.00	0	0	-637
0+40	1.00	0.00	0	0	1.00	819.56	149	149	1.00	0	0	1.00	0	0	-786
0+45	1.00	0.00	0	0	1.00	854.54	155	155	1.00	0	0	1.00	0	0	-941
0+50	1.00	0.00	0	0	1.00	860.34	159	159	1.00	0	0	1.00	0	0	-1100
0+55	1.00	0.00	0	0	1.00	856.46	159	159	1.00	0	0	1.00	0	0	-1259
0+60	1.00	0.00	0	0	1.00	856.43	159	159	1.00	0	0	1.00	0	0	-1417
0+65	1.00	0.00	0	0	1.00	859.50	159	159	1.00	0	0	1.00	0	0	-1576
0+70	1.00	0.00	0	0	1.00	863.88	160	160	1.00	0	0	1.00	0	0	-1736
0+75	1.00	0.00	0	0	1.00	869.80	161	161	1.00	0	0	1.00	0	0	-1896
0+80	1.00	0.00	0	0	1.00	895.51	163	163	1.00	0	0	1.00	0	0	-2060
0+85	1.00	0.00	0	0	1.00	906.95	167	167	1.00	0	0	1.00	0	0	-2227
0+90	1.00	0.00	0	0	1.00	892.66	167	167	1.00	0	0	1.00	0	0	-2393
0+95	1.00	0.00	0	0	1.00	884.38	165	165	1.00	0	0	1.00	0	0	-2558

ALIGNMENT: 22
SURFACE 1: toe22
SURFACE 2: raven22

					ADJ				ADJ ********* ADDED QUANTITIES						
BASELINE STATION NUMBER	STAT CUT FACT	STAT CUT AREA	STAT CUT VOL	STAT CUT VOL	STAT FILL FACT	STAT FILL AREA	STAT FILL VOL	STAT FILL VOL	ADJ CUT FACT	CUT VOL	CUT VOL	FILL FACT	FILL VOL	ADJUSTED FILL VOL	MASS ORDINATE VOLUME
1+00	1.00	0.00	0	0	1.00	872.92	163	163	1.00	0	0	1.00	0	0	-2721
1+05	1.00	0.00	0	0	1.00	858.93	160	160	1.00	0	0	1.00	0	0	-2881
1+10	1.00	0.00	0	0	1.00	849.93	158	158	1.00	0	0	1.00	0	0	-3039
1+15	1.00	0.00	0	0	1.00	844.95	157	157	1.00	0	0	1.00	0	0	-3196
1+20	1.00	0.00	0	0	1.00	852.45	157	157	1.00	0	0	1.00	0	0	-3353
1+25	1.00	0.00	0	0	1.00	899.15	162	162	1.00	0	0	1.00	0	0	-3515
1+30	1.00	0.00	0	0	1.00	910.32	168	168	1.00	0	0	1.00	0	0	-3683
1+35	1.00	0.00	0	0	1.00	902.48	168	168	1.00	0	0	1.00	0	0	-3851
1+40	1.00	0.00	0	0	1.00	894.92	166	166	1.00	0	0	1.00	0	0	-4017
1+45	1.00	0.00	0	0	1.00	897.52	166	166	1.00	0	0	1.00	0	0	-4183
1+50	1.00	0.00	0	0	1.00	904.41	167	167	1.00	0	0	1.00	0	0	-4350
1+55	1.00	0.00	0	0	1.00	911.08	168	168	1.00	0	0	1.00	0	0	-4518
1+60	1.00	0.00	0	0	1.00	916.90	169	169	1.00	0	0	1.00	0	0	-4687
1+65	1.00	0.00	0	0	1.00	921.92	170	170	1.00	0	0	1.00	0	0	-4858
1+70	1.00	0.00	0	0	1.00	923.54	171	171	1.00	0	0	1.00	0	0	-5029
1+75	1.00	0.00	0	0	1.00	925.44	171	171	1.00	0	0	1.00	0	0	-5200
1+80	1.00	0.00	0	0	1.00	930.19	172	172	1.00	0	0	1.00	0	0	-5372
1+85	1.00	0.00	0	0	1.00	936.89	173	173	1.00	0	0	1.00	0	0	-5544
1+90	1.00	0.00	0	0	1.00	940.28	174	174	1.00	0	0	1.00	0	0	-5718
1+95	1.00	0.00	0	0	1.00	940.55	174	174	1.00	0	0	1.00	0	0	-5892

ALIGNMENT: 22
SURFACE 1: toc22
SURFACE 2: raven22

ADJ ********* ADDED QUANTITIES

BASELINE STATION NUMBER	STAT CUT FACT	STAT CUT AREA	STAT CUT VOL	STAT CUT VOL	ADJ STAT FILL FACT	STAT FILL AREA	STAT FILL VOL	STAT FILL VOL	ADJ ADJ CUT FACT	CUT VOL	CUT VOL	FILL FACT	FILL VOL	ADJUSTED FILL VOL	MASS ORDINATE VOLUME
2+00	1.00	0.00	0	0	1.00	939.96	174	174	1.00	0	0	1.00	0	0	-6067
2+05	1.00	0.00	0	0	1.00	939.55	174	174	1.00	0	0	1.00	0	0	-6241
2+10	1.00	0.00	0	0	1.00	942.36	174	174	1.00	0	0	1.00	0	0	-6415
2+15	1.00	0.00	0	0	1.00	939.43	174	174	1.00	0	0	1.00	0	0	-6589
2+20	1.00	0.00	0	0	1.00	923.74	173	173	1.00	0	0	1.00	0	0	-6762
2+25	1.00	0.00	0	0	1.00	906.20	169	169	1.00	0	0	1.00	0	0	-6931
2+30	1.00	0.00	0	0	1.00	873.09	165	165	1.00	0	0	1.00	0	0	-7096
2+35	1.00	0.00	0	0	1.00	722.51	148	148	1.00	0	0	1.00	0	0	-7244
2+40	1.00	0.00	0	0	1.00	517.99	115	115	1.00	0	0	1.00	0	0	-7358
2+45	1.00	0.25	0	0	1.00	264.65	72	72	1.00	0	0	1.00	0	0	-7431
2+50	1.00	0.00	0	0	1.00	32.55	28	28	1.00	0	0	1.00	0	0	-7458
2+54	1.00	0.00	0	0	1.00	0.00	3	3	1.00	0	0	1.00	0	0	-7461

SOMERVILLE DEPOT PILE 1

VOLUME REPORTS

Triangle Volume Report

Original Surface: somtoe
Design Surface: somer1

Cut (cu yd)	Fill (cu yd)	Net (cu yd)
0.04	13011.18	-13011.15

Grid Volume Report

Original Surface: somtoe
Design Surface: somer1

Cut (cu yd)	Fill (cu yd)	Net (cu yd)
0.01	13008.95	-13008.94

ALIGNMENT: somer1
SURFACE 1: somtoe
SURFACE 2: somer1

				ADJ				ADJ ********* ADDED QUANTITIES							
BASELINE STATION NUMBER	STAT CUT FACT	STAT CUT AREA	STAT CUT VOL	STAT CUT VOL	STAT FILL FACT	STAT FILL AREA	STAT FILL VOL	STAT FILL VOL	ADJ CUT FACT	CUT VOL	CUT VOL	FILL FACT	FILL VOL	ADJUSTED FILL VOL	MASS ORDINATE VOLUME
0+00	1.00	0.00	0	0	1.00	3.28	0	0	1.00	0	0	1.00	0	0	0
0+05	1.00	0.00	0	0	1.00	102.92	10	10	1.00	0	0	1.00	0	0	-10
0+10	1.00	0.00	0	0	1.00	265.31	34	34	1.00	0	0	1.00	0	0	-44
0+15	1.00	0.00	0	0	1.00	422.12	64	64	1.00	0	0	1.00	0	0	-108
0+20	1.00	0.00	0	0	1.00	551.43	90	90	1.00	0	0	1.00	0	0	-198
0+25	1.00	0.00	0	0	1.00	648.94	111	111	1.00	0	0	1.00	0	0	-309
0+30	1.00	0.00	0	0	1.00	742.10	129	129	1.00	0	0	1.00	0	0	-438
0+35	1.00	0.00	0	0	1.00	823.21	145	145	1.00	0	0	1.00	0	0	-583
0+40	1.00	0.00	0	0	1.00	896.69	159	159	1.00	0	0	1.00	0	0	-742
0+45	1.00	0.00	0	0	1.00	958.16	172	172	1.00	0	0	1.00	0	0	-914
0+50	1.00	0.08	0	0	1.00	1023.45	183	183	1.00	0	0	1.00	0	0	-1097
0+55	1.00	0.00	0	0	1.00	1073.15	194	194	1.00	0	0	1.00	0	0	-1291
0+60	1.00	0.00	0	0	1.00	1104.74	202	202	1.00	0	0	1.00	0	0	-1493
0+65	1.00	0.00	0	0	1.00	1136.25	207	207	1.00	0	0	1.00	0	0	-1700
0+70	1.00	0.00	0	0	1.00	1165.79	213	213	1.00	0	0	1.00	0	0	-1914
0+75	1.00	0.00	0	0	1.00	1170.63	216	216	1.00	0	0	1.00	0	0	-2130
0+80	1.00	0.00	0	0	1.00	1199.92	219	219	1.00	0	0	1.00	0	0	-2349
0+85	1.00	0.00	0	0	1.00	1201.83	222	222	1.00	0	0	1.00	0	0	-2572
0+90	1.00	0.00	0	0	1.00	1204.51	223	223	1.00	0	0	1.00	0	0	-2795
0+95	1.00	0.00	0	0	1.00	1207.20	223	223	1.00	0	0	1.00	0	0	-3018

ALIGNMENT: somer1
SURFACE 1: somtoe
SURFACE 2: somer1

BASELINE STATION NUMBER	STAT CUT FACT	STAT CUT AREA	STAT CUT VOL	STAT CUT VOL	ADJ STAT FILL FACT	STAT FILL AREA	STAT FILL VOL	STAT FILL VOL	ADJ ADJ CUT FACT	********** ADDED QUANTITIES CUT VOL	CUT VOL	FILL FACT	FILL VOL	ADJUSTED FILL VOL	MASS ORDINATE VOLUME
1+00	1.00	0.00	0	0	1.00	1211.35	224	224	1.00	0	0	1.00	0	0	-3242
1+05	1.00	0.00	0	0	1.00	1219.82	225	225	1.00	0	0	1.00	0	0	-3467
1+10	1.00	0.00	0	0	1.00	1231.43	227	227	1.00	0	0	1.00	0	0	-3694
1+15	1.00	0.00	0	0	1.00	1226.23	228	228	1.00	0	0	1.00	0	0	-3921
1+20	1.00	0.00	0	0	1.00	1267.68	231	231	1.00	0	0	1.00	0	0	-4152
1+25	1.00	0.00	0	0	1.00	1343.35	242	242	1.00	0	0	1.00	0	0	-4394
1+30	1.00	0.00	0	0	1.00	1431.65	257	257	1.00	0	0	1.00	0	0	-4651
1+35	1.00	0.00	0	0	1.00	1543.14	275	275	1.00	0	0	1.00	0	0	-4926
1+40	1.00	0.00	0	0	1.00	1670.80	298	298	1.00	0	0	1.00	0	0	-5224
1+45	1.00	0.00	0	0	1.00	1796.17	321	321	1.00	0	0	1.00	0	0	-5545
1+50	1.00	0.00	0	0	1.00	1974.05	349	349	1.00	0	0	1.00	0	0	-5894
1+55	1.00	0.00	0	0	1.00	2160.75	383	383	1.00	0	0	1.00	0	0	-6277
1+60	1.00	0.00	0	0	1.00	2264.55	410	410	1.00	0	0	1.00	0	0	-6687
1+65	1.00	0.00	0	0	1.00	2306.21	423	423	1.00	0	0	1.00	0	0	-7110
1+70	1.00	0.00	0	0	1.00	2311.43	428	428	1.00	0	0	1.00	0	0	-7538
1+75	1.00	0.00	0	0	1.00	2306.42	428	428	1.00	0	0	1.00	0	0	-7965
1+80	1.00	0.00	0	0	1.00	2295.30	426	426	1.00	0	0	1.00	0	0	-8391
1+85	1.00	0.00	0	0	1.00	2289.78	425	425	1.00	0	0	1.00	0	0	-8816
1+90	1.00	0.00	0	0	1.00	2288.48	424	424	1.00	0	0	1.00	0	0	-9240
1+95	1.00	0.00	0	0	1.00	2287.18	424	424	1.00	0	0	1.00	0	0	-9663

ALIGNMENT: somer1
SURFACE 1: somtoe
SURFACE 2: somer1

BASELINE STATION NUMBER	STAT CUT FACT	STAT CUT AREA	STAT CUT VOL	STAT CUT VOL	ADJ STAT FILL FACT	STAT FILL AREA	STAT FILL VOL	STAT FILL VOL	ADJ ADJ CUT FACT	CUT VOL	CUT VOL	FILL FACT	FILL VOL	ADJUSTED FILL VOL	MASS ORDINATE VOLUME
									********* ADDED QUANTITIES						
2+00	1.00	0.00	0	0	1.00	2292.57	424	424	1.00	0	0	1.00	0	0	-10087
2+05	1.00	0.00	0	0	1.00	2301.63	425	425	1.00	0	0	1.00	0	0	-10513
2+10	1.00	0.00	0	0	1.00	2320.35	428	428	1.00	0	0	1.00	0	0	-10941
2+15	1.00	0.00	0	0	1.00	2321.37	430	430	1.00	0	0	1.00	0	0	-11371
2+20	1.00	0.00	0	0	1.00	2277.56	426	426	1.00	0	0	1.00	0	0	-11796
2+25	1.00	0.00	0	0	1.00	1982.93	394	394	1.00	0	0	1.00	0	0	-12191
2+30	1.00	0.00	0	0	1.00	1538.48	326	326	1.00	0	0	1.00	0	0	-12517
2+35	1.00	0.00	0	0	1.00	1052.62	240	240	1.00	0	0	1.00	0	0	-12757
2+40	1.00	0.00	0	0	1.00	602.68	153	153	1.00	0	0	1.00	0	0	-12910
2+45	1.00	0.00	0	0	1.00	238.02	78	78	1.00	0	0	1.00	0	0	-12988
2+50	1.00	0.00	0	0	1.00	4.86	22	22	1.00	0	0	1.00	0	0	-13010
2+53	1.00	0.00	0	0	1.00	0.00	0	0	1.00	0	0	1.00	0	0	-13011

REPORT DOCUMENTATION PAGE

Form Approved
OMB No. 0704-0188

1.AGENCY USE ONLY ***(Leave blank)***

2.REPORT DATE
August 1996

3.REPORT TYPE AND DATES COVERED
Final report

4.TITLE AND SUBTITLE
Noninvasive Weight Determination of Stockpiled Ore Through Microgravity Measurements

5.FUNDING NUMBERS
MIPR SC08006-10

6.AUTHOR(S)
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7.PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES)
U.S. Army Engineer Waterways Experiment Station
3909 Halls Ferry Road
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8.PERFORMING ORGANIZATION REPORT NUMBER
Miscellaneous Paper
GL-96-24

9.SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)
Defense National Stockpile Center
Fort Belvoir, VA 22060

10.SPONSORING/MONITORING AGENCY REPORT NUMBER

11.SUPPLEMENTARY NOTES
Available from the National Technical Information Service, 5285 Port Royal Road, Springfield, VA 22161.

12a.DISTRIBUTION/AVAILABILITY STATEMENT
Approved for public release; distribution is unlimited.

12b.DISTRIBUTION CODE

13.ABSTRACT ***(Maximum 200 words)***
The Defense National Stockpile Center (DNSC) maintains stockpiles of high-grade ores at various locations throughout the country and has a requirement to produce current mass estimates for selected piles as part of a national audit. Microgravity measurements were performed over each ore pile to provide high-resolution surveys of the gravitational field with which to determine the average bulk density of the ore material. Nettleton's and Parasnis' methods were used to analyze the gravity anomaly data. These methods have the advantage of averaging the effect of density variations more accurately than can be done from surface or core samples. Volumes of the ore stockpiles were determined using standard land surveying method. The computed weight for each ore stockpile is compared to the reported weight provided by DNSC. The greatest differences were computed over piles located on unprepared, sandy soil. Ore stockpiles situated on prepared surfaces or concrete pads typically have computed differences less than 10 percent.

14.SUBJECT TERMS
Geophysical methods
Microgravity
Ore stockpiles

15.NUMBER OF PAGES
162

16.PRICE CODE

17.SECURITY CLASSIFICATION OF REPORT	18.SECURITY CLASSIFICATION OF THIS PAGE	19.SECURITY CLASSIFICATION OF ABSTRACT	20.LIMITATION OF ABSTRACT
UNCLASSIFIED	UNCLASSIFIED		